Integrated Corrective Action Process Phase D Interactive Database

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by

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DISCLAIMER

This thesis is submitted as partial and final fulfillment of the cooperative work experience requirements of Kettering University needed to obtain a Bachelor of Science in Mechanical Engineering Degree.

The conclusions and opinions expressed in this thesis are those of the writer and do not necessarily represent the position of Kettering University or Tank-Automotive Research, Development & Engineering Center (TARDEC), or any of its directors, officers, agents, or employees with respect to the matters discussed.

PREFACE

This thesis represents the capstone of my five years combined academic work at Kettering University and job experience at Tank-Automotive Research, Development & Engineering Center (TARDEC). Academic experience in Mechanical Engineering, proved to be valuable assets while I developed this thesis and addressed the problem it concerns.

Although this thesis represents the compilation of my own efforts, I would like to acknowledge and extend my sincere gratitude to the following persons for their valuable time and assistance, without whom the completion of this thesis would not have been possible:

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I. INTRODUCTION

The Integrated Corrective Action Team (ICAT) designed the Integrated Corrective Action Process (ICAP) to help the Warfighter, who is everyone that is involved with defending the United States, by reducing the time and resources required to resolve their engineering issues. In addition to the ICAP, a secure online collaborative database is required to reduce the time and resources required to resolve these engineering issues. The development of the database is the last phase of the ICAP. It has been determined that the Windchill® software seems to offer the features that the ICAT is looking for. To break ground in Phase D, a gap analysis will be performed between the requirements of the ICAP and the capabilities of Windchill®.

Problem Topic

The Integrated Corrective Action Team (ICAT) needs the development of a collaborative environment that is secure and accessible to all authorized users that will track, store, and archive information while aiding in streamlining the ICAP.

Background

The Tank-Automotive & Armaments Command (TACOM) Life Cycle Management Command (LCMC) is part of the United States (U.S.) Army's soldier and ground systems community. Within the TACOM LCMC there are four organizations shown in Figure 1; U.S. Army Tank-Automotive and Armaments Command (TACOM),

Program Executive Office Combat Support & Combat Service Support (PEO CS&CSS), Program Executive Office Ground Combat Systems (PEO GCS), and Program Executive Office Soldier (PEO Soldier). Assisting those four organizations are three enterprise partners; the Armaments Research Development & Engineering Center (ARDEC), the Tank Automotive Research, Development & Engineering Center (TARDEC), and the Natick Soldier Center (NSC). As a community, they work to provide the best possible support to the Warfighter.
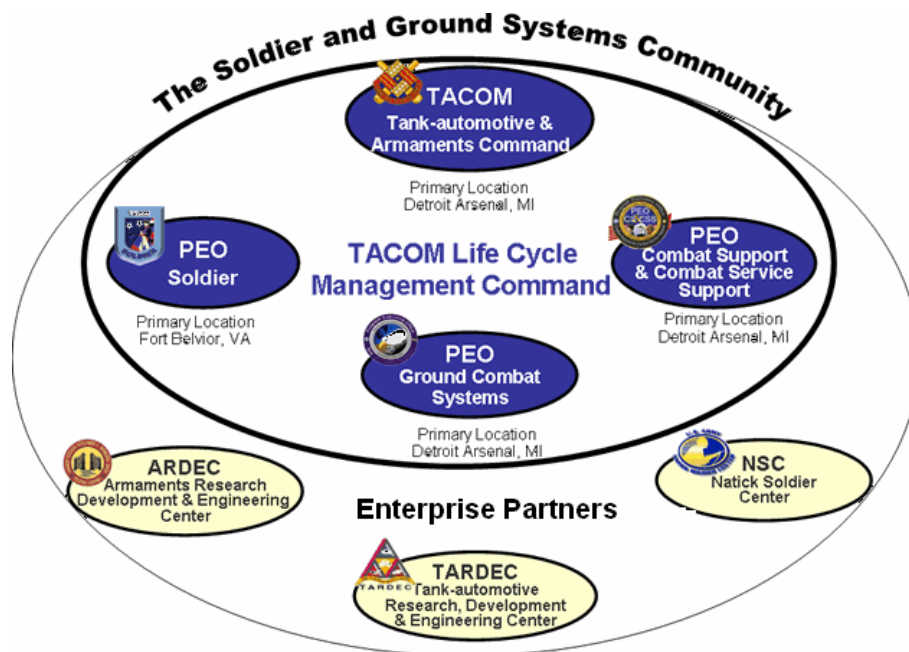
Figure 1. Organization Map. From TACOM website. (http://www.tacomlcmc.army.mil/).

The TACOM LCMC integrates the Army's Acquisition, Logistics, and Technology (AL&T) responsibilities, authorities, and processes to create a closer bond between all of the partners and organizations within the community. Together they ensure that products reach the Soldier faster, develop better products than the current ones, and minimize the cost of a product's life cycle. Currently, the TACOM LCMC is refocusing their effort toward the management of systems to deliver the Warfighter quality, reliability, and performance capabilities with greater readiness. The future direction is on process identification and ownership, with improved effectiveness and efficiency to benefit the Warfighter. In a step toward these goals, the ICAT developed the ICAP, which has a main role in handling the recurring Warfighter field issues that require a more in-depth solution. An Associate Director from the Engineering Business Group formed the ICAT, which consisted of one program manager, three engineers from TARDEC, two analysts from outside organizations and one IT Tech support.

The ICAT developed the ICAP under the notion that engineering issues, in and around TACOM LCMC, are handled at personnel levels much higher then they should be, creating wasted time and resources. Additionally, there was not a standard process in place to handle these issues in an efficient way, which leads to repetitive circles and lack of resolution on the Warfighter's side. Upon this realization, the ICAT begin the development of an efficient process that would be adaptable to many types of issues. The resulting ICAP utilizes the Lean Six Sigma (LSS) methodology. The ICAT identified that the process would need to be broken up into phases in order to obtain the final goal. The ICAP contained three core phases A, B, and C. Underlying the three phases is a storage

database labeled Phase D, where the ICAT would store and archive information pertaining to each issue.

Work began on Phase A and near its completion; ICAT acquired a pilot engineering issue to run through the first phase of the newly created process. While piloting the engineering issue, work continued on the ICAP and toward the end of Phase A, the author joined the team. The author began to aid in piloting the engineering issue and the development of Phases B and C. During this time, the author became accustomed to some of the LSS tools and the ICAP. Soon after phases B and C were completed, ICAT acquired additional engineering issues. Work on Phase D never initiated due to the new engineering issue consuming all of the ICAT's time.

The ICAT is running the process manually and storing information and documents in their team folder on a server share drive. This is becoming more difficult as the number of issues rise and the time available to obtain, categorize, and store information decreases. The ICAT developed the ICAP with an online collaborative database in mind, but the ICAT did not initiate Phase D due to limited resources. Soon the author brought to the table a need for a thesis and the team decided to resource and task the author with learning the LSS methodology and breaking ground on Phase D. Windchill® is the preferred tool for the database implementation. Windchill®, developed by PTC, is a process management software suite discussed in detail in chapter V. To determine whether Windchill® is the proper tool, the author performed a gap analysis.

Criteria and Parameter Restrictions

The author performed a gap analysis between the ICAP requirements and Windchill®'s capabilities. A gap analysis is an excellent tool for identifying pitfalls that

may occur between what is currently performed during the ICAP and what would be performed while operating in Windchill®. Windchill® is the software of choice due to availability and current usage at TARDEC. The gap analysis must use the LSS methodology due to its Army-wide recognition and ability to streamline processes. The LSS methodology has a number of tools that serve in different ways. From these tools, the author is to identify the ones that suit the need of the gap analysis. This particular gap analysis requires tools that can outline a present and future process at different levels and provide an in depth review of identified deficiencies. Upon completion of the analysis, the author will give a conclusion and recommendations toward resolution of identified deficiencies.

Methodology

Lean Six Sigma (LSS) methodology is used for the gap analysis but specifically the Concept, Design, Optimize, and Verify (CDOV) steps are utilized. The LSS tools used for this project, within each step are:

Concept

1. Plan of Attack & Milestones (POA&M)
2. Process Observation
3. Critical Functions
4. Program Plan
5. Design Requirements

Design

1. Benchmark Report
2. As-Is and To-Be
    a. Suppliers, Inputs, Process, Outputs, Customers (SIPOC)
    b. Swim-lane Flow Chart
    c. Value Stream Analysis
3. Cause & Effect with the "5 Whys"
4. Failure, Mode, Effect, Criticality, Analysis (FMECA)

Optimize

1. Critical- to-quality requirements
2. Deficiency identification & Resolution plan

Verify

1. Process Analysis

Primary Purpose

The primary purpose of the thesis is to perform a gap analysis between the ICAP and Windchill® in order to identify deficiencies and to give recommendations toward resolution of the identified deficiencies.

Overview

Following the Introduction, Chapter II will be the conclusion and the author's recommendations to correct the deficiencies found during the analysis. Chapter III will define what a gap analysis is, the specifics on why the author chose the CDOV plan, and the LSS tools used for the analysis. Chapter IV will describe the ICAP by outlining the specific steps taken to resolve issues and the general actions that occur within each step. Chapter V will define Windchill® as it stands as an off-the-shelf software suite, highlighting its key tools that the ICAP will utilize. The final chapter, Chapter VI will be the analysis between the ICAP requirements and Windchill®'s capabilities. Within Chapter VI there includes a discussion on the advantages and disadvantages of the software and the identification of deficiencies between the ICAP needs and what Windchill® can offer. Appendices at the end of the thesis include ICAP templates, Windchill® standard operating procedures, along with the LSS tools used in the gap analysis.

II. CONCLUSION AND RECOMMENDATIONS

Recommendations

Following the resolution of the identified deficiencies (Table 1), the ICAP can

begin to utilize Windchill® as a process management and storage tool. Most resolutions

should be relatively simple, with the most difficult being the training of new users.

Table 1

Identified deficiencies and author's recommendations

#	Identified Deficiencies	Author's Recommendations
1	ICAP does not have a ICAP Windchill® homepage	Develop a complete set of requirements that the ICAT would be looking for that conforms to the needs of our customers. Contact the ACE team to discuss our intentions and begin work on developing an ICAP Windchill® homepage. Include on the homepage the submission form for issuing possible ICAP issues. For this to occur ICAT must take funding into consideration.
2	ICAP does not have a way for issue initiators to contact the ICAT without word of mouth.	Develop the ICAP web site on the AKO web page with complete information on what the ICAT can provide the TACOM LCMC community. Provide directions on how to obtain access to Windchill®.
3	ICAT does not have a head Windchill® project developer	ICAP management must appoint a lead Windchill® project developer that will work with the ACE team and learn how to develop a new project. The appointed individual should be the Windchill® administrator and learn all of the functions of the software so that they may act as a consultant for problem that may arise.

4	ICAP does not have a Windchill® project template.	ICAT currently has a working template for our share server that they can utilize within Windchill®. To develop the Windchill® template, ICAT must contact the ACE team and work with them to develop it to contain all of ICAT's document templates and folder structure. The ICAT should also make the ICAP's standard operating procedures (SOP) accessible to everyone. Accessibility could be either on the ACE team web page in their SOP area or on an AKO ICAP website. The author suggests placing the SOPs on an AKO ICAP website so that all needed information is available in one location.
5	ICAT members do not have Windchill® access.	Require all ICAT members to obtain Windchill® access from the ACE team.
6	Stakeholders do not have Windchill® access.	Require all stakeholders to obtain Windchill® access from the ACE team. Provide the stakeholders an SOP on who to contact and what information is required to obtain access.
7	ICAT and Stakeholder do not know how to use Windchill®.	Develop a short training slide show that will familiarize new users with Windchill® and provide them the basic skills needed to utilize the system. Also, develop standard operating procedures on how to work with the Windchill® tools to provide navigation through the system.
8	There is no way to obtain immediate directions without contacting the ICAT first for issue initiation.	Provide on the web site the requirements of an issue and the items that need to follow, to initiate an issue. Include directions on how to obtain Windchill® access and possibly work with the ACE team to develop workflow within Windchill® that forward a complete issue initiation document to the ICAT.
9	Issues that are currently stored in the team share folder.	Allow time for the appointed Windchill® project developer to become familiar with developing new projects within Windchill®. Then, when time permitting; they could develop new projects in Windchill® for each closed issue that is in the team share folder. Following the development of the projects for each issue, ICAT can upload the closed ICAP issue documents into the Windchill® system.

Conclusion

Integrating the ICAP into Windchill® should be a smooth transition with most of

the issues arising from the lack of Windchill® experience. Windchill® access is available

to the ICAT at no cost, but ICAT will have to pay for the work that is required from the ACE team. The author has outlined the required work in Table 1. The ICAP shall remain unchanged and the team may find areas to evolve as the knowledge of Windchill® within the team grows. The author found no change in cost to run the ICAP utilizing Windchill® but an initial cost of training resources will arise. To develop a fully tailored Windchill®, the ICAT will have to pay for the services of the ACE Team.

The main advantage of utilizing Windchill® is to provide everyone in the TACOM LCMC a searchable database of ICAP issues. The database does not simplify the process but does have potential to streamline the submission of possible ICAP issues. To utilize that potential the ICAT will have to work with the ACE team to develop an issue initiation screen on an ICAP Windchill® homepage, discussed in Table 1.

Documents and other information will be slightly more difficult to store due to uploading instead of saving on the team share server. Uploading may seem more cumbersome at first but will provide the ICAP issue information to everyone in and around the TACOM LCMC who has been granted permission by the ICAT.

The ICAT has tailored the ICAP well, to utilize Windchill® as a process management and storage tool. Even as the ICAP evolves, Windchill® will have the capabilities to evolve with it. Full integration of the ICAP into Windchill® will provide the process streamline functionality that the Warfighter requires. Completion of the fully functional ICAP will allow the ICAT to hand off the process to other military groups to further their processing ability.

III. GAP ANALYSIS

Identifying similarities and differences between systems for future integration is a gap analysis. The gaps between the systems prevent complete integration and require resolution prior to combining the systems. A gap analysis can utilize a number of methodologies and tools to achieve the desired goal depending on the system. The Lean Six Sigma (LSS) methodology is required for this project and an ICAP team member suggested the Concept, Design, Optimize, Verify (CDOV) approach rather then the commonly used Design, Measure, Analyze, Improve, Control (DMAIC) approach, due to the nature of the project. Upon further research, it was found that the DMAIC approach is tailored to the development of a process and not the integration of systems. The CDOV approach lends itself to concept development, which the integration of systems is relying on. Within each portion of the CDOV approach, LSS tools where identified for use during the gap analysis.

The concept portion focuses the project and defines the time line, plan, and requirements in the following way:

1. Plan of Attack & Milestones (POA&M)
2. Project Plan
3. Process Observation
4. Critical Functions

5. Design Requirements

The Plan of Attack & Milestones (POA&M) creates direction and deadlines for different phases of the project. It structures the project into three phases and defines sections within each phase. Each section includes a definition for completion thus breaking up the project into workable pieces. The project plan identifies the goals and outlines the approach toward completion. Review of the Standard Operating Procedures (SOP) and aiding the ICAT with engineering issue resolution, enabled the author to observe the process. Learning and observing a process helps to identify pitfalls that will occur during the integration of systems. Lastly, the critical functions and design requirements put boundaries on the systems that are analyzed. The critical functions identify the important parameters that the system is required to do. The design requirements simplify the systems by identifying the important aspects. Figure 2 provides a simplified POA&M example of purchasing a new engineering and enhancing its performance and handling. The left side of the figure is the POA, which describes the different phases and the tasks that are required to complete each phase. Completion of each phase of the process is a milestone. The right side of the figure is the table and graphical representation of completed tasks and milestones.

Simplified Plan of Attack Model
New Car Performance and Handling

The goal of the project is to purchase a new vehicle and improve its performance and handling.

Phase I – Purchase new vehicle

- Task I: Research possible vehicles
  - Task I will be completed by surfing the internet for vehicles that are of interest and speaking to current owner of that make and model vehicle.

- Task II: Locate vehicle dealer and make a purchase
  - Task II will be completed by searching the yellow pages and contacting dealerships for the availability of the vehicle of choice. Once a dealership is located, that has the vehicle of choice, travel there and make the purchase.

Phase II – Improve performance

- Task III: Replace air intake
  - Task IV will be completed by researching, purchasing and installing an air intake system that fits the vehicle and provides the desired increase in horsepower.

- Task IV: Replace exhaust
  - Task V will be completed by researching, purchasing and installing an exhaust system that fits the vehicle and provides the desired increase in horsepower.

Phase III – Improve handling

- Task V : Replace springs and dampeners
  - Task VI will be completed by researching, purchasing and installing a spring and dampener system that fits the vehicle and provides the desired handling characteristics.

Task	Start Date	Completion Date	Today Date	Days Completed	Days Remaining
TASK-1	9/25/2006	11/1/2006	3/15/2007	172	0
TASK-2	9/25/2006	12/29/2006	3/15/2007	172	0
TASK-3	11/1/2006	12/15/2006	3/15/2007	135	0
TASK-4	12/15/2006	12/29/2006	3/15/2007	91	0
TASK-5	3/26/2007	4/13/2007	3/15/2007	0	19
Milestone 1	11/1/2006	11/1/2006	3/15/2007	135	0
Milestone 2	12/29/2006	12/29/2006	3/15/2007	77	0
Milestone 3	4/13/2007	4/13/2007	3/15/2007	0	1

New Car Performance and Handling
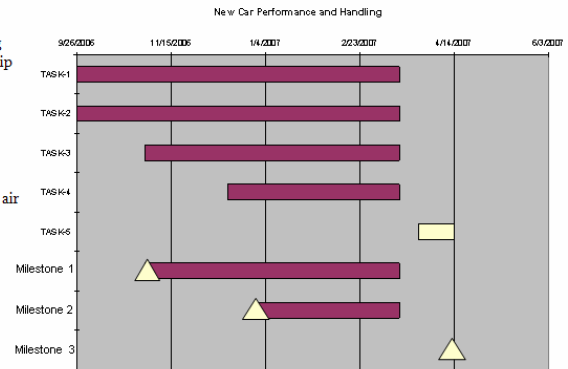
Figure 2. Simplified Plan of Attack & Milestones Model.

Completion of the system concepts allows the design to begin. The design of the system depends on the requirements and in this case, system process mapping is key to mapping both the current (As-Is) process and the future (To-Be) process. Design begins by benchmarking the systems to learn their structures and capabilities. This project includes benchmarking of the ICAP and Windchill®, reported in chapters three and four. Benchmarking Windchill®'s capabilities that aid the ICAP was completed. Detailed maps of the systems (As-Is and To-Be process maps) help to identify how the process currently runs and how the process could run after the systems integration. Depending on what is required, there are different level maps. Levels begin at Level 0 and become more detailed with each level increase. For example, Figure 3 shows an example of different

level maps of Flint Michigan. Level 1 reveals details within an area on the Level 0 map and Level 2 reveals details within an area on the Level 1 map.
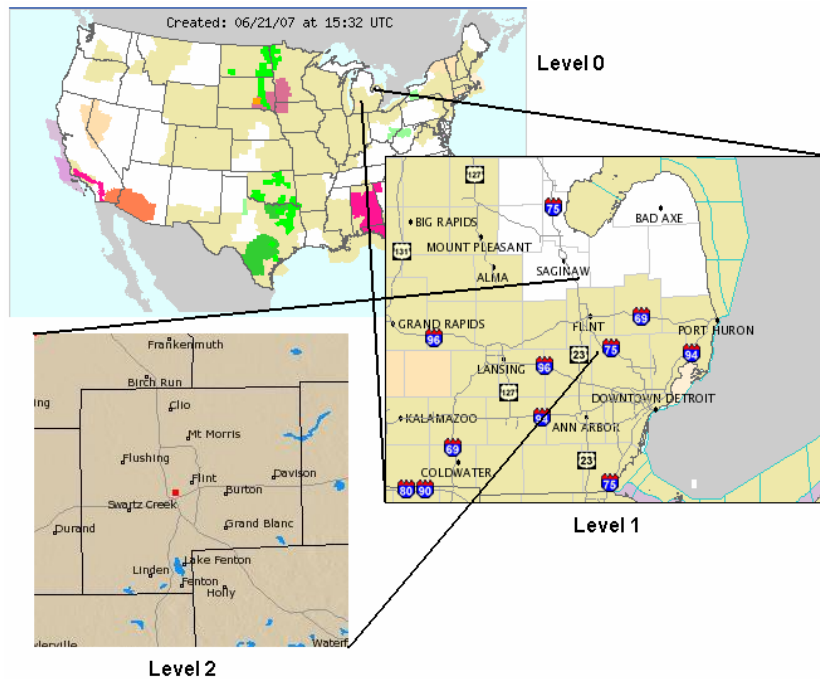
Figure 3. Level 0, 1, 2 Map Example (www.noaa.gov)

There are several different types of maps that can be constructed and the ones that were for this project are below.

1. As-Is and To-Be
   a. Suppliers, Inputs, Process, Outputs, Customers (SIPOC)
   b. Swim-lane Flow Chart
   c. Value Stream Analysis
   d. Cause & Effect with the "5 Whys"

The SIPOC identifies the flow of information or product into and out of a process. This is important to reveal major changes to the flow of information or product into and out of a process. Figure 4 provides the general design of the tool and how it could be used

to lay out a process. This Level 0 map describes how apple juice reaches the store from the farmers in a simplified model.

Suppliers		Inputs		Process		Outputs		Customers
Apple Farmer		Apples		Squeeze Apples & Bottle the Juice		Bottled Juice		Grocery Store
						Apple Pulp		
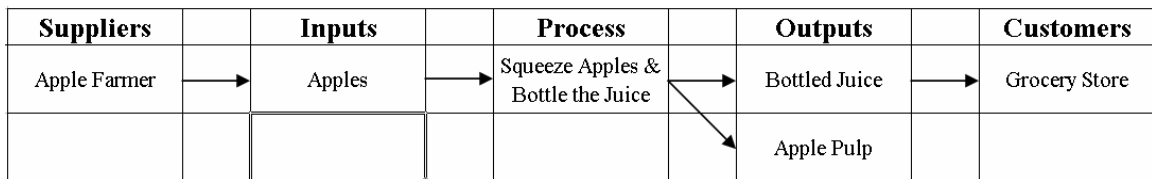
Figure 4. SIPOC (Simplified Apple Juice Model)

Swim-lane Flow Charts provide detailed systematic process information throughout an entire system. Figure 5 provides the design of the tool with a simplified example of a corn farm starting with the planting of the corn seeds to the final consumers purchase.
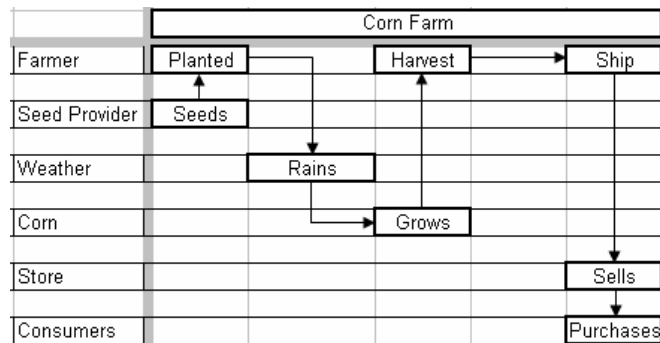
Figure 5. Swim-lane Flow Chart (Simplified Corn Farm Model)

Value Stream Analysis provides an ability to identify the cost to run a process. In this project the value stream analysis is performed on both the As-Is and To-Be Swim-lane Flow Charts to provide comparison between the current process and future process. The analysis will provide the possible cost savings of the alteration to the process. The tool does this by categorizing the work performed into three areas: value-added, business non-value-added, and non-value added. Value-added work is what the customer is willing to pay for, if they know that you are doing it. Business non-value-added work does not add value to the product but is required to perform the value-added work or by law. Non-value-added work does not add value to the product and the process does not require it.

Eliminate non-value-added work from a process when possible. Figure 6 is an example of a value stream analysis applied to the previous corn farm example. In the example, the farm estimated a production of three thousand heads of corn and sold them at twelve heads for $2.50. The cost of the seeds where estimated at five seeds for $0.50. The results of the value stream analysis show six days of Value-Added (VA) and eighty-seven days of Business Non-Value-Added (BNVA) work. There was no Non-Value-Added (NVA) work found. Estimates of three thousand heads of corn cost approximately $6.72 per day to produce. That resulted in $40.32 of VA work and $584.64 of BNVA work.

		V A	N V A	B N V A		V A	N V A	B N V A		V A	N V A	B N V A		V A	N V A	B N V A		
									Corn Farm									
Farmer	Planted	2				Harvest	2		→	Ship	1							
Seed Provider	Seeds		1															
Weather					Rains													
Corn								→	Grows			85						
Store										Sells		1						
Consumers										Purchases	1							
														Totals (Days)	Totals ($)
VA		2					2				2				6	$40.32
NVA															0	$0.00
BNVA			1					85				1			87	$584.64
															93	$624.96
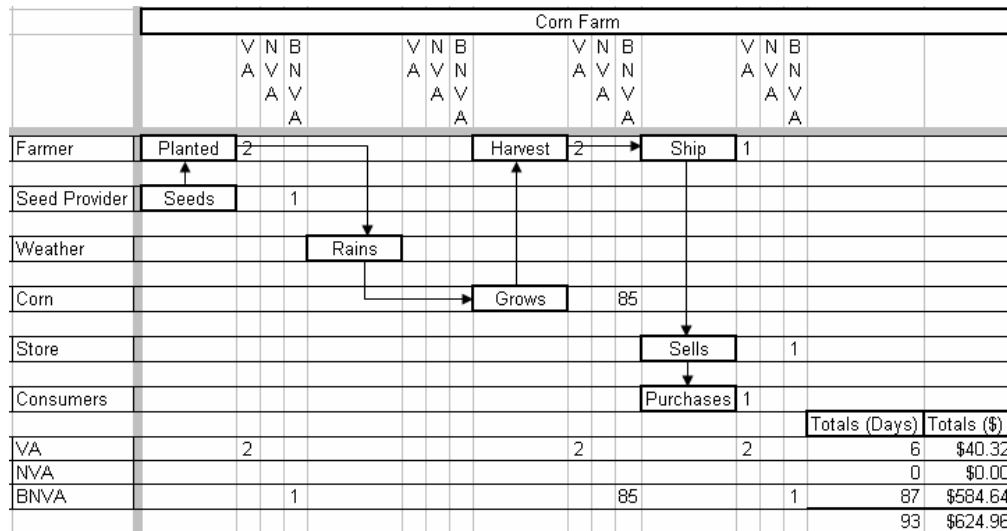
Figure 6. Swim-lane Flow Chart with Value Stream Analysis

The Cause & Effect diagram (also known as Fishbone or Ishakawa diagram) is used to brainstorm ideas on possible root causes. The diagram is constructed with different subject "legs" that stem from a problem statement. In this project the subjects include: Process, Communication, Workplace Environment, and Personnel. To expand on the problems in order to bring them down to a root cause, the "5 Whys" are used. The "5 Whys" ask the question "why?" until the user cannot answer the question. Asking why may take a few times or several times. When the user cannot answer the question, it is typically possible to step one question up and label that answer as the root cause. A problem can have many root causes, each in different subject legs. The Cause & Effect, coupled with the "5 Whys", helps to provide the areas that require resolution. Figure 7 provides a simplified example and the general structure.

Root Cause——→ The problem
Why?
Because there is a problem
Why?
Because there is a reason to create a process
Why?
Because they where assigned to create a process
Why?
Because someone created a process
Why?
There is a process

Process

Communication

Problem Statement

Work Place Enviroment

Personnel
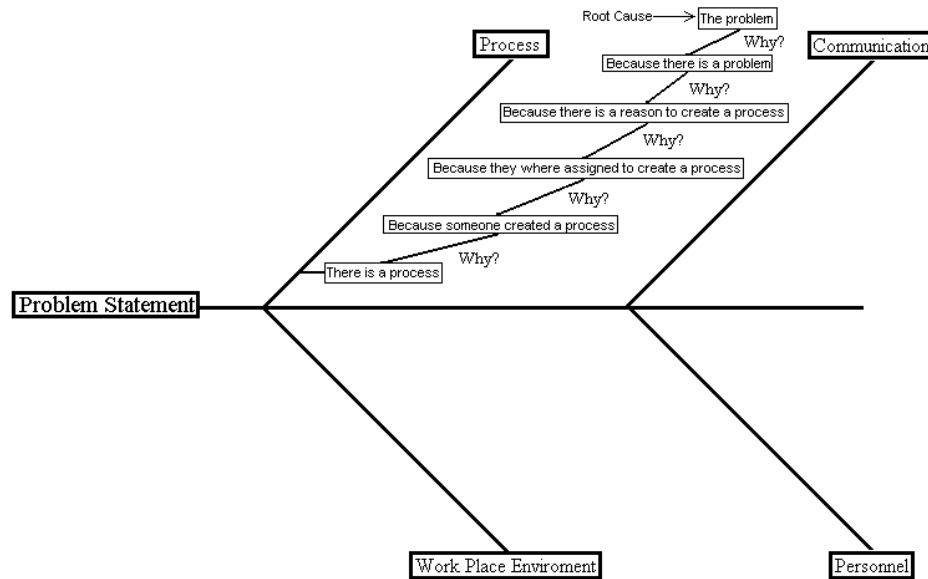
Figure 7. Fishbone Diagram with the "5 Whys?"

Failure Mode Effect Criticality Analysis (FMECA) is a systematic evaluation tool used to identify, analyze and prioritize possible failure modes and their effects in order to resolve them in order of greatest to least importance. Identification of failure modes occur by brainstorming possible failures, while the analysis helps to determine the effect the failure may have on the system. Figure 9 provides a simplified example of a FMECA that utilizes the Swim-Lane flow chart corn farm model. Each column of the process provides a step to the process. For each step, an analysis is performed to identify the possible failures.

Prioritizing is done by assigning a severity and occurrence number to the failure and a detection number to the cause. The severity numbers range from 1 to 5 with 5 as the worst severity. Shown in the example (Figure 9), each failure mode was assigned a severity number utilizing intuition and knowledge of the process.

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1. Minor: Opportunity for improvement
2. Low: Fault isolation and corrective action required; not urgent
3. Moderate: Product, service, or process operational with impaired capability
4. Severe: Product, service, or process severely degraded; immediate corrective action required
5. Catastrophic: Product, service, or process is non-operational or there is a direct safety risk to personnel, product, or environment

The occurrence number also ranges from 1 to 5 with 5 indicating the highest level if occurrence. The same intuition and knowledge is utilized to determine an occurrence number for each failure mode in the example (Figure 9) based on how often it occurs.

1. Remote < 0.1%
2. Low < 1.0%
3. Moderate < 10%
4. Frequent >10%
5. High >15%

The detection numbers range from 1 to 5 with 5 indicating the lowest level of detection. Again using intuition and knowledge, the final step is to assign a detection number based on the detectability of the cause.

1. Very High > 99%
2. High 96-99%
3. Moderate 80-95%
4. Low 70-79%
5. Very Low < 70%

Upon assigning each category a number they are then multiplied together to provide a Risk Priority Number (RPN). The RPN allows for the sorting of the failures from greatest to least threatening. To further reveal the greatest threats to the system a criticality analysis is performed to set higher priority on step five severities and to drop down low severity, high detection failures that are not as important. Criticality values are critical 1, critical 2, medium, and minor with critical 1 being the greatest threat. Once the sorting is complete, resolutions to the failures may begin.

Process Step/Input	Potential Failure Mode	Potential Failure Effects	S E V	Potential Causes	O C C	Current Controls	D E T	R P N	Criticality
Step 2	There is a drought	The seeds will not grow	5	Unpredictiable weather	3	No control	5	75	critical 1
Step 1	Farmer does not receive the seeds	The farmer will not be able to plant the seed.	5	The shipment of seed was lost.	2	No control	5	50	critical 1
Step 4	The corn does not get shipped	Unable to provide corn to the consumers	3	Shipping schudle becomes mixed up.	5	No control	4	60	medium
Step 3	Corn crops destroyed	Unable to provide corn to the consumers	4	Insects	2	Insectaside	5	40	medium
Step 3	Corn crops destroyed	Unable to provide corn to the consumers	4	Flood	2	No control	5	40	medium
Step 3	Equipment has broken down	Prevents the farmer from harvesting	3	Old equipment	2	Maintanence schdule	4	24	minor
Step 3	The corn does not grow	The seed does not have the proper nutrients	4	The farmer has expented the crop land due to consistant use	1	Utilize crop rotation	3	12	minor
Step 3	The corn does not grow	The seed does not have water	4	The farmer does not utilize earagation system	1	Farmer utilizes earagation system when necessary	1	4	minor
Step 4	Customers do not buy the corn	Farmer does not profit	3	Corn cost to much	1	No control farmer must make some profit		0	minor

Figure 8. Failure Mode Effect Criticality Analysis (FMECA) example

System optimization typically occurs for a system as a whole. Integrating the ICAP into Windchill® is a step toward optimizing the ICAP. Optimization within this project occurs with the identification of deficiencies and the recommendation of resolutions during integration of the ICAP into Windchill®. Once the deficiencies are identified, a resolution plan for each deficiency can be developed. Upon launch of the two integrated systems, further optimization may be required. The user verifies the gap analysis by walking through each step of the ICAP and reanalyzing each for new discrepancies that have not been resolved during the gap analysis.

A gap analysis is an excellent tool that a user can define in many ways to compare two or more systems. The analysis is open-ended and requires the discretion of the user to identify the appropriate tools for proper use. This, of course, leaves many areas open for improvement but there is confidence in the results of the thesis.

IV. THE ICAP

The Integrated Corrective Action Team (ICAT) designed the Integrated Corrective Action Process (ICAP) to reduce the time and resources required to resolve the Warfighter's engineering issues. To do this, the ICAT envisioned a process that would take incoming issues and vet them to determine whether there truly is an issue. Once ICAT determines there is an issue, then they can develop a solution and implementation plan. ICAT also envisioned a historical data based for future reference of all issues that have passed through the ICAP.

To accomplish the vision, the ICAT was formed consisting of one program manager, three engineers from TARDEC, two analysts from outside organizations and one IT Tech support. The ICAT decided that the process was large enough to split it into three parts. The first part consisted of vetting the incoming issues and the second and third consisted of solution development and implementation.

Issues enter the ICAP at two locations. Entering at the vetting stage is the most common, but it is possible to enter straight into the solution development stage. Vetting an issue determines whether it is truly a problem that requires resolution. If someone has totally replaced or redesigned the part or system then it is not an issue. Issues that do require resolution continue on to the solution development stage.

ICAT accomplished issue vetting in several steps shown in Figure 9.
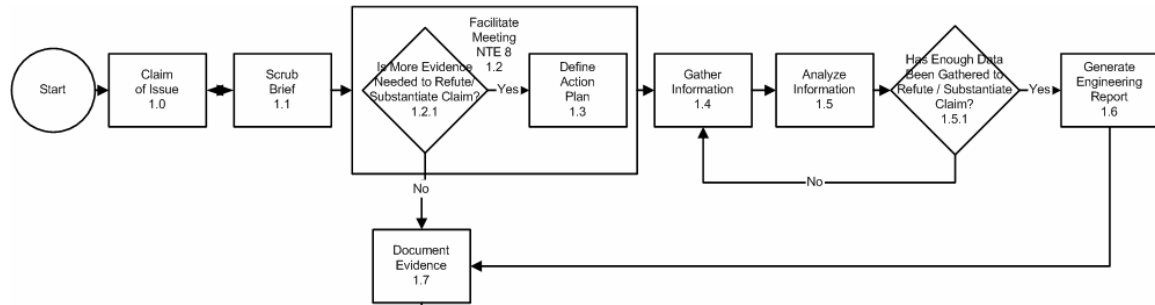
Figure 9. Vetting Phase of the Integrated Corrective Action Process

The issue enters into Claim of Issue (1.0). 1.0 tags important information to the

issue for historical reference. Within 1.0 the following steps are taken:

1. Issue is entered into the Integrated Corrective Action (ICA) Master Indexing
   Matrix
      a. Create tracking number
            i. Format is YYYY.MM.DD.##
      b. Enter Initiation Date
      c. Enter Issue Description
      d. Enter who the Issue Initiator is - Person/Organization bringing issue to
         ICAP
      e. Enter Notes
      f. Fill in event dates as they pass
2. Master File Structure
      a. Copy and re-name using tracking number assigned above
      b. Save in ICA Process - Working Files for Issues
3. Send email to Associate Director (AD) requesting who should be involved in the
   issue (if necessary – once Project Manager (PM) has agreed)
4. Create Distribution List/Meeting Sign-In Sheet
      a. Use instructions / Standard Operating Procedure (SOP) for creating sign in
         sheet from distribution list
      b. List of all persons involved (issue specific)
      c. Turn Distribution List into Meeting Sign-In Sheet

       d. Responsible, Accountable, Consulted, Informed (RACI) on Meeting Sign-In Sheet
            i. Roles designated for all persons involved

5. Create 3-ring binder (Issue Binder)
    a. Spine and front labels with ICA tracking number
    b. Issue Specific Action Item Log (ISAIL)
    c. Meeting Sign-In (hard copy)
    d. Reference Materials
    e. Issue specific information gathered
    f. Binder allows for:
         i. Quick reference
        ii. Portability
      iii. "Passing on" to substitute on day off / vacation etc.

Completion of 1.0 steps the issues onto Scrub Brief (1.1). 1.1 combs through the issue and pulls out information and points of contact (POC). ICAT analyzes the issue in preparation of the next step. Within 1.1 the following steps are taken:

1. ICA Issue Initiation Requirements
    a. Work with Issue Initiator to ensure all relevant data is included in the Issue Initiation Brief/Communication
         i. Phone conferences
        ii. Face to face meetings
      iii. ICAT only meetings
      iv. ICAT + Subject Matter Experts (SME) / PM / Other meetings
2. Reference Materials
    a. Information Sources
    b. Vehicle Information Sheets
3. ICA Cause & Effect
    a. Root Cause indicator to be used at Facilitated Technical Meeting
4. ICA Plan of Attack (PoA)
    a. ICAT researched Action Items/Short-Mid-Long term goals to be used at Facilitated Technical Meeting
5. ICA Master Indexing Matrix
    a. Update
6. ICA Issue Specific Action Item Log (ISAIL)
    a. Update any Action Items assigned
    b. Document any information gathered
7. ICA Meeting Sign-In
    a. Add persons-contacted/primary/along the way
8. ICA Meeting Minutes
    a. Capture discussion or emails from initiators
    b. Save hard copy in Issue Binder
9. ICA Meeting Agenda

a. Prepare for Technical Meeting
b. Distribute to meeting attendees (see Meeting Sign-In)
c. Attach read-ahead materials

Completion of 1.1 steps the issue onto the Facilitated Meeting (1.2). 1.2 allows

for all of the stakeholders to meet and communicate about the issue. During the meeting,

the stakeholders decide on whether the issue requires further pursuit. If the issue does not

require pursuit, it will close and ICAT will document the results for historical reference.

ICAT carries the role of facilitator and recorder to keep the meeting flowing and on track.

Within 1.2, ICAT does the following:

1. Meeting Coordination
   a. Initial meeting coordination done by phone if needed
   b. Ensure a representative from each organization is able to attend
      i. ICAT Facilitator
      ii. ICAT Recorder
2. ICA Meeting Prep Checklist
   a. See Meeting Prep Checklist for details

Step 1.2 may close the issue or it may require a move to the next step. If the issue

closed, the next step is Document Evidence (1.7). If the issue remains open, the next step

is Define Action Plan (1.3). 1.3 occurs during the facilitated meeting. The Action Plan

sets the course of actions to find the root cause or causes of the issue. The Action Plan

assigns tasks to individuals and incurs accountability to enforce the required actions be

taken to close the issue in a timely manner. Within 1.3, ICAT performs the following

steps:

1. Make every attempt to Define / Concur in 1.2 (facilitated meeting)
2. ICA Cause & Effect
   a. Program Management Tool to develop preliminary questions for PoA
3. ICA PoA
   a. Fully developed and concurred at Facilitated Technical Meeting
   b. Action Items input on ISAIL for tracking
4. ICA Meeting Minutes
   a. Distribute to Distribution List

      b.   Save hard copy in Binder

After the meeting, with an Action Plan completed, the ICAT moves the issue into

the Gather Data (1.4) step. 1.4 relies on the stakeholders who where assigned action items

to respond with answers. During 1.4 the following is performed:

1. ICA Issue Specific Action Item Log (ISAIL)
    a. Follow up on the Action Items entered from the Facilitated meeting
2. Enter data gathered onto the second tab onto the info/doc page of the ISAIL
    a. Add a link to the document gathered in the info/doc page

Completion of 1.4, moves the issue into Analyze Data (1.5). The ICAT is

responsible for reviewing the data obtained to ensure it contains all required information.

Throughout the review process, ICAT emails status updates to all stakeholders to keep

them informed. During 1.5 ICAT performs the following steps:

1. Review all data gathered from previous steps (all formats)
2. ICA Status Update - ICA Team lead (or designate) send out

Once the ICAT has received the required information, the team makes some

conclusions and recommendations and moves the issue to the next step, Generate

Engineering Report (1.6). Within 1.6 ICAT performs the following steps:

1. Create Engineering Report
    a. Develop with ICA Executive Summary template
    b. Link data sources if requested

Completion of 1.2 or 1.6 steps the issue into Document Evidence (1.7). Whether

the issue is closed after 1.2 or 1.6, the evidence and rationale for the closure is recorded

for historical reference. To record the information, ICAT takes the following steps:

1. Update
    a. ICA Master Indexing Matrix
    b. ICA ISAIL
    c. ICA TAIL
2. Record
    a. Date closed

b. Refute/Decision
c. Substantiate
3. PoA complete
4. Team lead or designate verifies all steps taken/checked

After completion of 1.7, a decision is made (regardless of the decision made during 1.2) on whether the issue requires more evidence to refute or substantiate the claim of issue solution development. If the issue does not require a solution, the issue moves to Close Issue (1.8). If the issue requires a solution then it moves to Review Issue (2.1). The possibility exists that a Project Manager (PM) can approach the ICAT with a pre-vetted and request assistance in developing a solution. Therefore, the issue would enter the Start PM On-Ramp (2.0) step.

The ICAT accomplished solution development in several steps shown in Figure 10.
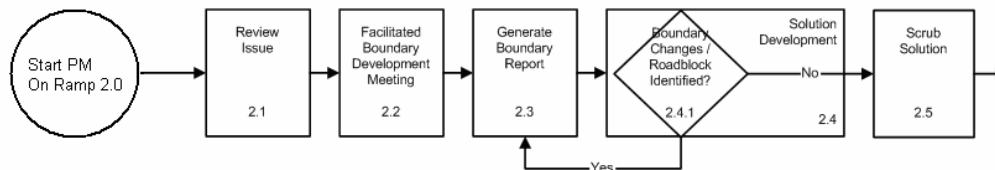
Figure 10. Solution Development Phase of the Integrated Corrective Action

Steps within 2.0 are the same as in 1.0 and are as follows:

Start PM On-Ramp (2.0)

(Issue comes directly into Solution Development or Implementation phase)

1. Issue is entered into the Integrated Corrective Action (ICA) Master Indexing Matrix
   a. Create tracking number

      i.   Format is YYYY.MO.DY.##
- b. Enter Initiation Date
- c. Enter Issue Description
- d. Enter who the Issue Initiator is - Person/Organization bringing issue to ICAP
- e. Enter Notes
- f. Fill in event dates as they pass
2. Master File Structure
   - a. Copy and re-name using tracking number assigned above
   - b. Save in ICA Process - Working Files for Issues
3. Send email to Associate Director (AD) requesting who should be involved in the issue (if necessary – once Project Manager (PM) has agreed)
4. Create Distribution List/Meeting Sign-In Sheet
   - a. Use instructions / Standard Operating Procedure (SOP) for creating sign in sheet from distribution list
   - b. List of all persons involved (issue specific)
   - c. Turn Distribution List into Meeting Sign-In Sheet
   - d. Responsible, Accountable, Consulted, Informed (RACI) on Meeting Sign-In Sheet
     - i. Roles designated for all persons involved
5. Create 3 ring binder (Issue Binder)
   - a. Spine and front labels with ICA tracking number
   - b. Issue Specific Action Item Log (ISAIL)
   - c. Meeting Sign-In (hard copy)
   - d. Reference Materials
   - e. Issue specific information gathered
   - f. Binder allows for:
     - i. Quick reference
     - ii. Portability
     - iii. "Passing on" to substitute on day off / vacation etc.

Whether the issue requires 2.0 it will enter Review Issue (2.1) for review of all

necessary information. Steps are as follows:

Review Issue (2.1)

1. ICA Issue Initiation Requirements
   - a. work with Issue Initiator to ensure all relevant data is included in Issue Initiation Brief/Communication using
     - i. Phone conferences
     - ii. Face to face meetings
     - iii. ICAT only meetings
     - iv. ICAT + SME / PM / Other meetings to scrub issue
2. Reference Materials
   - a. Information Sources

      b. Vehicle Information Sheets
3. ICA Cause & Effect
      a. Root Cause indicator to be used at Facilitated Technical Meeting
4. ICA PoA
      a. ICAT researched Action Items/Short-Mid-Long term goals to be used at Facilitated Technical Meeting
5. ICA Master Indexing Matrix
      a. Update
6. ICA Issue Specific Action Item Log (ISAIL)
      a. Update any Action Items assigned
      b. Document any information gathered
7. ICA Meeting Sign-In
      a. Add persons-contacted/primary/along the way
8. ICA Meeting Minutes
      a. Capture discussion or emails from initiators
      b. Save hard copy in Issue Binder
9. ICA Meeting Agenda
      a. Prepare for Technical Meeting
      b. Distribute to meeting attendees (see Meeting Sign-In)
      c. Attach read-ahead materials

Completing 2.1 steps the issue onto the Facilitated Boundary Development

Meeting (2.2). The meeting gathers the required stakeholders to develop boundaries for

the solution development. ICAT acts as the facilitator and recorder of the meeting,

stepping in when necessary to keep the meeting flowing. The following steps for the

meeting are:

1. Meeting Coordination
      a. Initial meeting coordination done by phone if needed
      b. Ensure a representative from each organization is able to attend
          i. ICAT Facilitator
          ii. ICAT Recorder
2. ICA Meeting Prep Checklist
      a. See Meeting Prep Checklist for details
3. Identify POC for Boundary Establishment, approval, and authorized to make changes to Established Boundaries.
      a. Boundary Establishment will be developed outside of meeting

After the Facilitated Boundary Development Meeting (2.2), ICAT moves to

Generate Boundary Report (2.3). ICAT develops the boundary report from all the known

information as follows:

Generate Boundary Report (2.3)

1. Review meeting minutes, notes, all data gathered, etc.
2. Create draft Boundary Report
3. Ask Assistant Project Manager (APM) who they want to approve the Boundary Report
4. Obtain approval from POC
5. Distribute Boundary Report

Once ICAT distributes the boundary report to the stakeholders, Solution

Development (2.4) begins. During the solution development stage, the boundary report

may need to be changed. If so, ICAT will make the changes upon POC approval and

redistribute it to the stakeholders. The steps for solution development are:

Solution Development (2.4)

1. If there are Boundary Changes
    a. Verify it is okay to change – GO BACK TO POC / PM
        i. If approved, make necessary changes to Boundary Report
        ii. Seek approval from identified PM POC on Boundary Report
        iii. Distribute Boundary Report to all involved
2. Solution Development
    a. Org tasked works to develop solution / implements testing plan
        i. Developers send updates to ICAP to track progress / history

When the solution developers reach a solution, ICAT must review it to ensure it

falls within the constraints of the boundary report. The ICAT will note all deviations

outside of the boundaries. ICAT does this by scrubbing the solution, step Scrub Solution

(2.5)

Scrub Solution (2.5)

1. Does Solution meet all the boundaries?
    a. ICA Gap Analysis

i. Check solution against boundary report – formal double check
                        Solution meets/does not meet boundaries
            b. Review w/ PM engineers
                    i. Yes – continue to step 2.6
                    ii. No – Return to step 2.3
                            1. Go back to PM

Solution implementation begins when the solution meets all of the boundaries and

is approved by the PM. ICAT is not responsible for developing the implementation plan

or implementing the solution, but may continue to track if necessary. If not, ICAT will

close the issue (step 1.8).

The ICAT accomplished solution implementation in a few steps shown in figure

11.
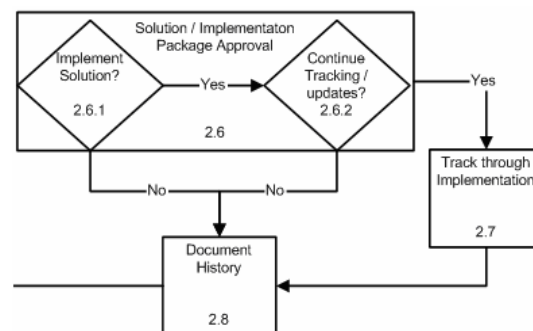
Figure 11. Solution Implementation Phase of the
Integrated Corrective Action Process

Solution/Implementation Package Approval (2.6)

    1. Create Package
            a. Solution Development details
            b. Gap Analysis
            c. Implementation Plan (created by developer)
    2. Implement Solution?
            a. Yes- Continue to track?
                    i. Yes – continue to step 1.7

        ii.   No – Close Issue (1.8)
    b.   No – Close Issue (1.8)

If the PM has requested the ICAT to track the solution implementation, the

following steps occur:

Track through Implementation (2.7)

1. Communicate with Implementation POC
2. Update ISAIL
3. Send Status Updates to PM

Whether the PM decides to implement or track the implementation, ICAT must

document the information on the solution. Step 2.8 Document History steps are as

follows:

Document History (2.8)

1. Update
    a.   ICA Master Indexing Matrix
    b.   ICA Issue Specific Action Item Log
    c.   ICAP Status Updates

The final step of the entire process, regardless of the route taken is Close Issue

1.8. To close an issue, ICAT takes the following steps:

Document History (1.8)

1. Update
    a.   ICA Master Indexing Matrix (Document Date Closed)
    b.   ICA ISAIL
2. Develop
    c.   ICA Executive Summary
        i.   Develop from template
        ii.   Send to stakeholders (document date sent in Master Indexing Matrix)

The ICAT has developed a process that is easy the follow and adaptable for

different issues. Utilization of the ICAP (Figure 12) has proven it efficient and effective.
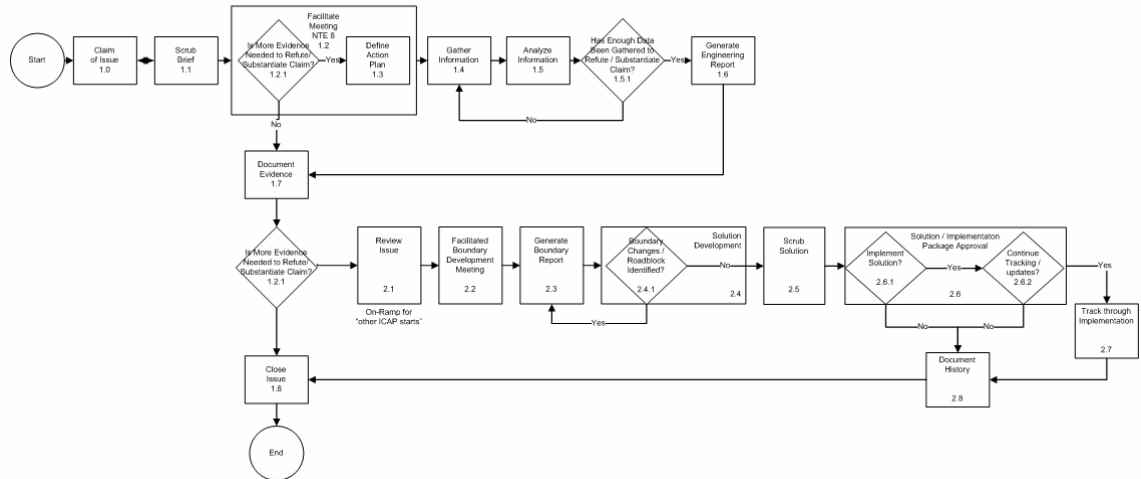
Figure 12. The Integrated Corrective Action Process

V. WINDCHILL®

Windchill® is software developed by PTC that enables the user to develop an online collaborative portal that a web browser can securely access. PTC developed Windchill® for process and information management. It offers separate modules of management depending on the user's requirements. Those modules include product, project, change, and library.

1. Product
   a. CAD drawings
   b. Serialized parts
      i. Serialized part is a common part utilized by multiple products.
2. Project
   a. Paperwork flow management
   b. Storage
3. Change is a module that creates an environment for the user to monitor only the items that require change.
4. Library acts as storage for commonly used parts, items, or documents that the users use throughout a system.

Windchill® is also capable of being tailored to perform a user's request. For example, a user may want a document that they received to transfer automatically to a person of

their choice for review. Upon review, the document would automatically transfer to another user for approval and then back to the original user. To accomplish this, the user would have to develop a workflow. Workflows control a document as it moves from start to finish. Tailoring can also change the look and feel of the software. A trained Windchill® process developer creates workflows based on the needs of the user. For the purpose of this thesis, the capabilities of Windchill® discussed reflect the standard structure of the project module without workflows.

Project

The project module manages all of the user's assigned projects. The project list screen (Figure 13) contains the name of all of the user's assigned projects, with other relevant information. The project list includes the owner of the project, host, phase, state, status, and percent done. The owner is the designated lead of the project. The host is the supplier of Windchill® and its servers. The phase and state, described in Tables 2 & 3, is the position of the overall project. The status provides quick reference with green, yellow, and red lights as to whether the project is on schedule. Percent done is how much the project is completed.
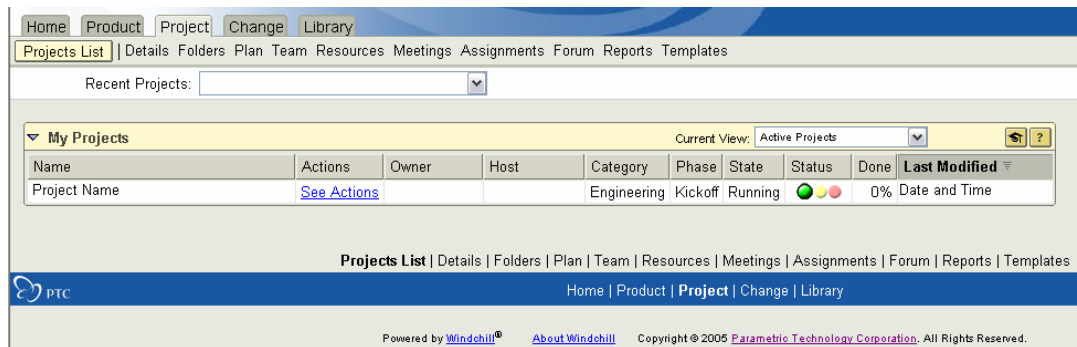
Figure 13. Windchill® Project List Screen Shot

Table 2

Project Phase and Description

Phase	Description
Kickoff	startup and initiation
Scoping	initial planning and scoping
Planning	detailed planning
Assignment	approval or commissioning
Development	active development
Wrap Up	final phases of development
Completed	project work is finished
Port Mortem	project review after completion
Cancelled	early termination of project before completion

Table 3

Project States and Description

State	Description
Defined	initial state of the plan when the project is created
Running	state of the plan during normal operations
Suspended	The plan is on hold
Cancelled	If the project is canceled, the plan is as well
Completed	You cannot restart the plan once it is completed

The details page (Figure 14) provides the same information given on the project list page, plus project start, finish, and deadline dates, the duration, and other relevant information.

Figure 14. Windchill®'s Project Details Page

A user utilizes a template to speed the process of developing a new project. When it is time to begin a new project, the creator simply runs the template and uploads the required information. The template can include the folder structure, future document templates, document workflows, and an initial contact list. It can be simple or complex. The final template depends on the user's requirements. A trained Windchill® developer must aid in the development of the template because it requires programming and first

hand knowledge of Windchill®. Templates are not necessary and a user may utilize

Windchill® without tailoring.

A user may begin by developing folders (Figure 15) in a standard Windchill®

project. The folder structure is similar to that of a personal computer's hard drive. For

example, Window's My Documents contains folders that contain documents and

additional folders created by the user. The user creates folders in specific locations and

saves documents in that folder. The difference between Windchill® and a personal

computer's hard drive is the looks of the program and the availability of the documents.

Windchill® is securely accessible from any location that has a web browser. There

is no limit to the amount of folders created. Stored within the folders, are Microsoft

Word, Excel, PowerPoint or any other file formats. The computer that is accessing the

documents must have the correct program installed to view and edit the documents. For

example, if a user needs to make changes to a Microsoft Word document, then Microsoft

Word would have to be installed on the computer.
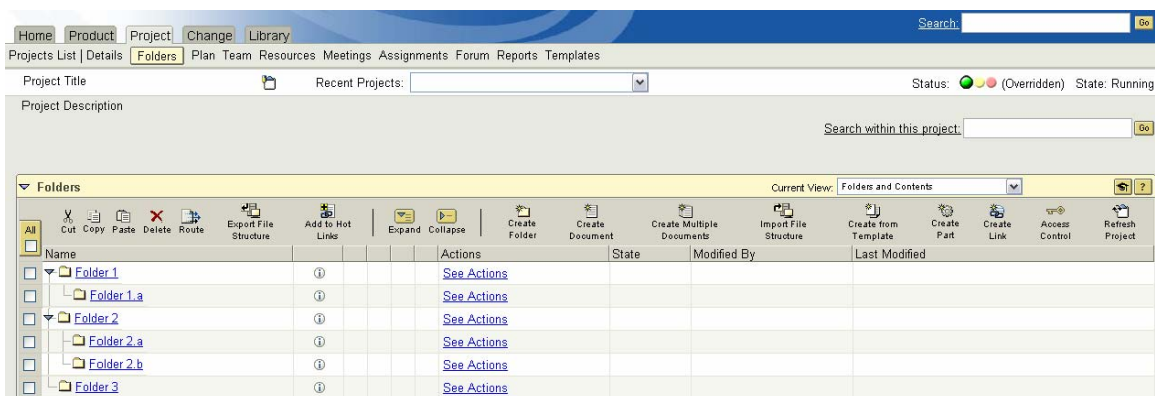
Figure 15. Windchill®'s Folders Screen Shot

Saving documents to the Windchill® project is slightly more difficult then saving to a personal computer's hard drive. To save the user must upload documents onto the server much as one would upload an attachment into an email. Uploading documents is what enables them to be available at multiple locations via a web browser. To download documents, simply click on the document title. In order to prevent others from making changes to the same document check it out and download. There is also the possibility of only checking the document out and not downloading, for later work. When work is complete, upload the document by clicking on See Actions (Figure 16), selecting Check In, and following the directions. When uploading a checked out document, Windchill® will save uploads as a new iteration, saving the old for reference.
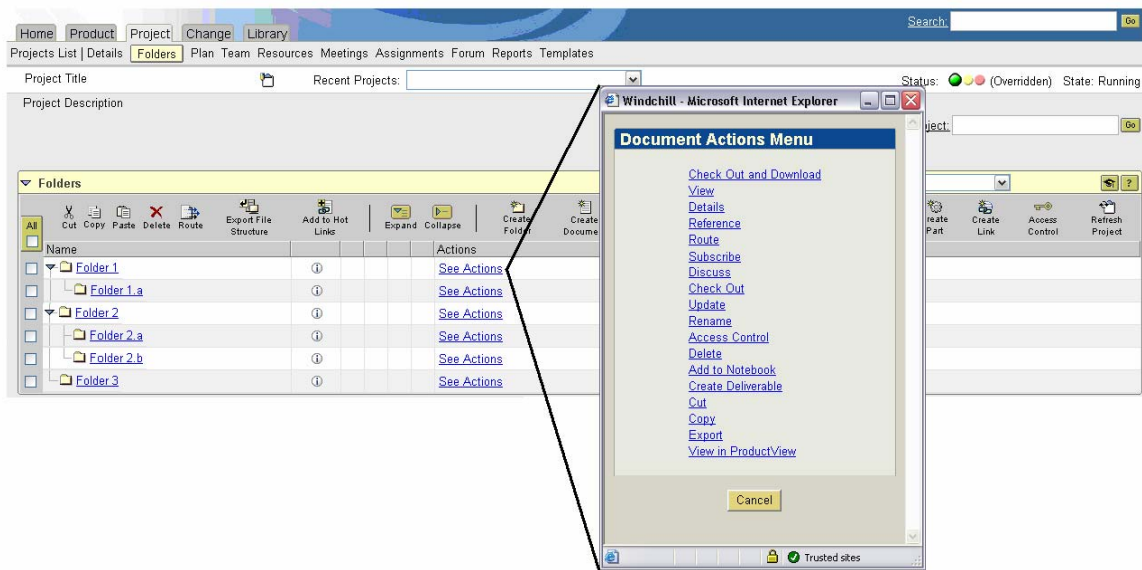
Figure 16. Exploded Actions Tab

When uploading a document into the project, it is available to all users that have

access. This is preventable by setting the access to either full, read, none, or update. The

creator of the document sets the user access, based on the user (Figure 17). Full access

indicates that the specified group has permission to read, write, and delete objects. Read

access indicates that the specified group has permission to view the object. None hides

the document from the list of specified users. Update indicates that the members have

permission to read and write to the document.

Figure 17. Windchill®'s Access Control Screen Shot

When work on a document is complete and uploaded, it is possible to route it to

another user for approval, notification, release, or review (Figure 18). Approval routing is

for obtaining final approval on a document. Notify routing informs a group of users that

there is a new or changed document to view. Release routing informs other users about

the release of a document. <u>Review</u> routing informs other users that a document is ready

for their review. Each routing is similar to each other; the titles provide the state of the

document.

Figure 18. Windchill®'s Document Routing Screen Shot

The router has the option to have Windchill® set and follow up on a deadline

when routing a document. When the document is behind schedule, Windchill® sends an

email to notify the user. The router sets the due date and how far in advance to notify the

receiver (Figure 19).

Figure 19. Route Due Date Screen Shot

Windchill® can task action items to users. When an action item is developed within Windchill®, it sends the user an email (Figure 20) providing them with information on the task and when it is due.
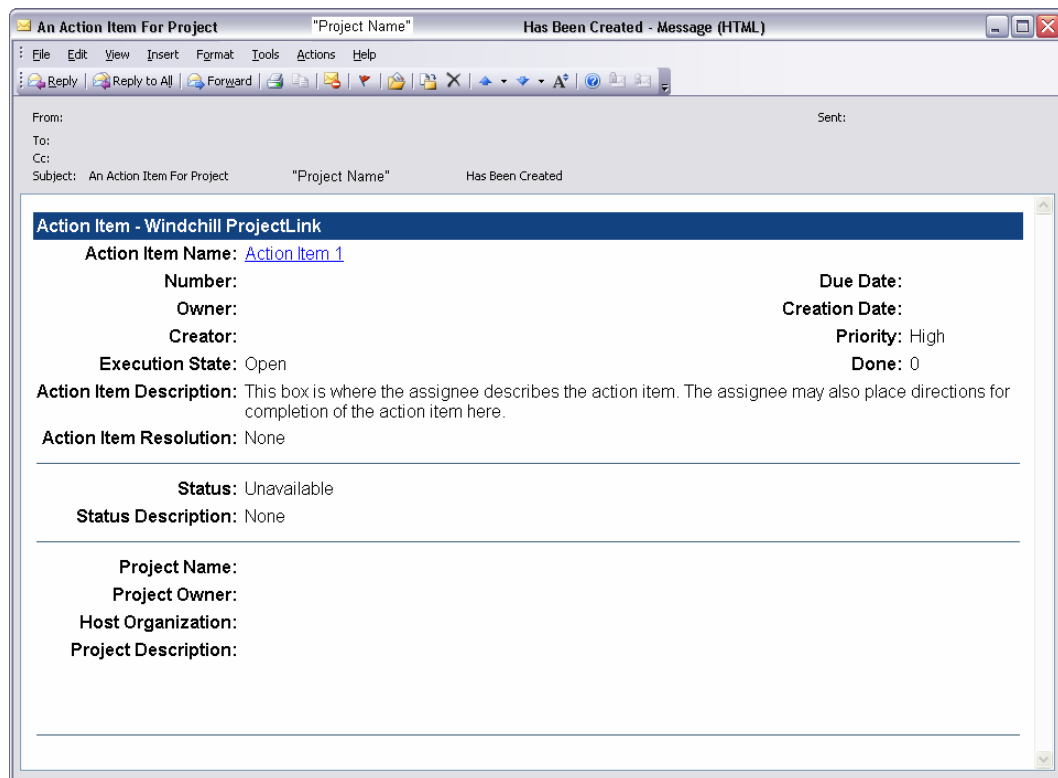
Figure 20. Action item email that the item owner receives

The assigner of the task creates the action item in the assignments area of the project (Figure 21) by clicking on the Create Action Item icon.
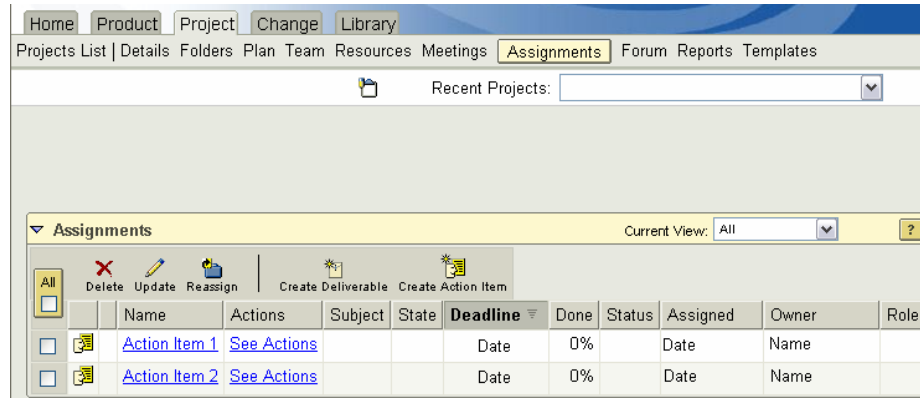
Figure 21. Windchill®'s assignments page

The assigner is then prompted (Figure 22) to assign the action item a title, the owner, item due date, and the priority. The assigner also has the option of providing a description and subscribing to the item so a notification is sent when the item is complete.
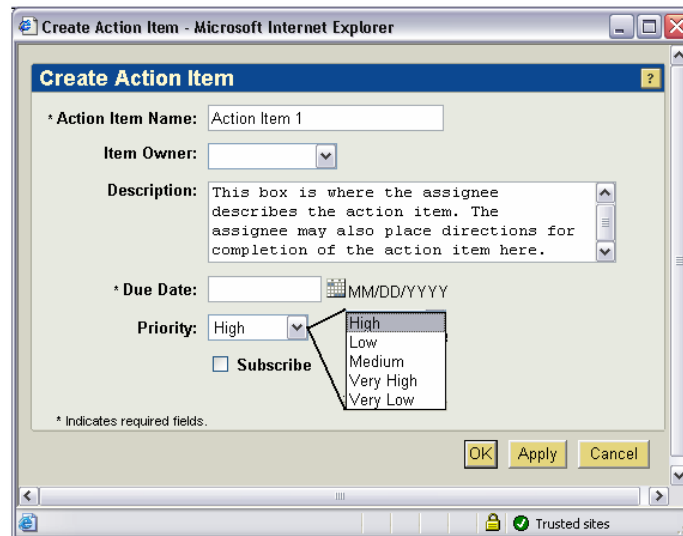
Figure 22. Create Action Item Prompt Screen

Subscribing allows users to notify themselves on when other users make document changes. Subscription is available by clicking See Actions (Figure 16) that is adjacent to the document and selecting subscribe. The user has the option of what they want to be notified of in the create subscription window (Figure 23).
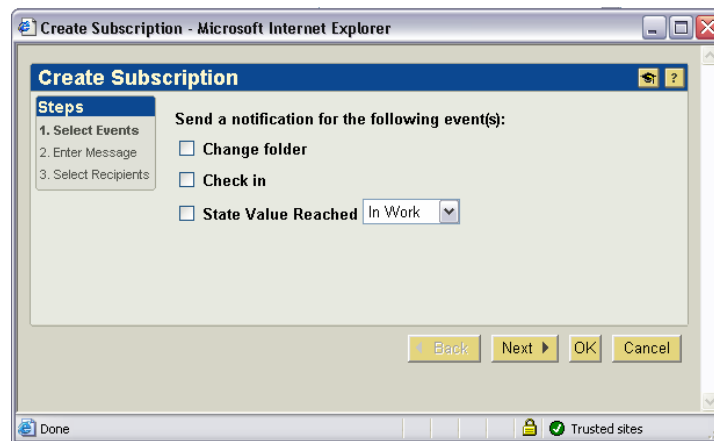
Figure 23. Creating Subscription Screen Shot

Included with each document is a discussion area (Figure 24). The user is able to access this area under See Actions. The discussion area is utilized to make notes on events or changes that surround that document. The user can create or delete topics as necessary.
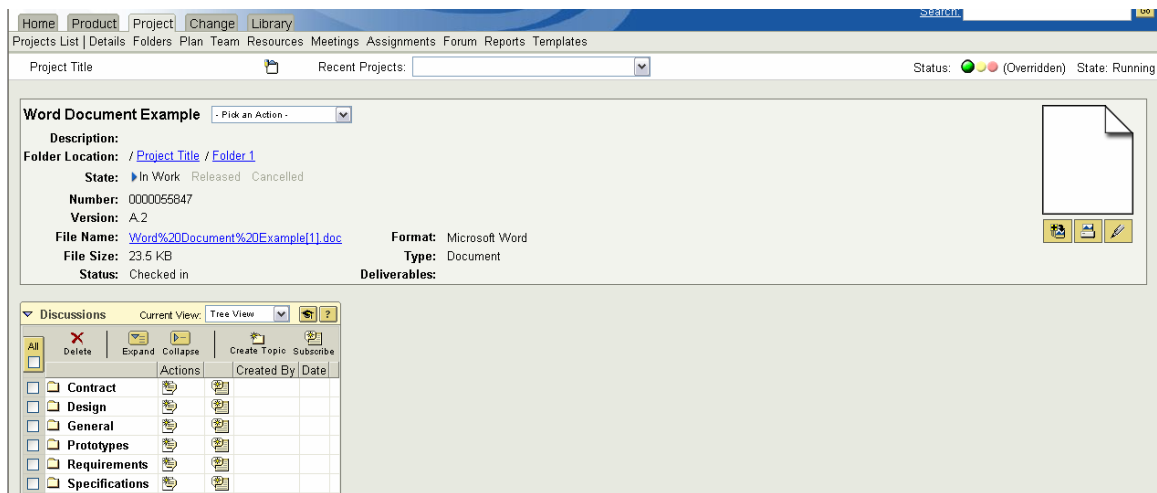
Figure 24. Documents Discussions Screen Shot Page

Windchill® is a highly versatile tool with many options. This description is just a small portion of its capabilities, but the functions described are the ones that will have the most impact to the ICAP.

VI. GAP ANALYSIS BETWEEN THE ICAP AND WINDCHILL®

The gap analysis is an identification of the similarities and differences between the Integrated Corrective Action Process (ICAP) and Windchill® that would occur while integrating the two systems. Each ICAP tool was analyzed and it was determined what would need to happen in order to incorporate it into Windchill®.

ICAP Tools

1. Master Indexing Matrix
   a. The master indexing matrix must be available on an ICAP homepage for access by the TACOM LCMC community. The matrix will provide the community up-to-date issue status.
2. Master File Structure
   a. ICAT can utilize the master file structure that is created on the share server in Windchill®
      i. The ICAT would need to recreate it in Windchill® manually or work with the ACE Team to develop a project template
   b. Windchill®'s folder structure will be identical to the folder structure on the share serve
3. Responsible, Accountable, Consulted, Informed (RACI)
   a. ICAT will upload the RACI into Windchill® with access properties properly set
      i. The access properties will prevent users from making unauthorized changes to the document, but provide the ability to view it
   b. ICAT will upload the RACI into the correct folder within Windchill® the same way they store it in the folders on the share server
4. Distribution List
   a. ICAT will develop Windchill's contact list for each project from the distribution list
5. Issue Initiation Requirements
   a. The issue initiation requirements will be available on an ICAP's Windchill® homepage
6. Reference Materials
   a. ICAT will upload reference material as it becomes available.
   b. Stakeholders may also have the ability to upload reference material
      i. The stakeholder needs to review a standard operating procedure for proper storage of the material prior to this occurring
7. Cause & Effect
   a. ICAT will upload the cause & effect into the appropriate folder
8. Plan of Attack

a. ICAT will upload the plan of attack into the appropriate folder

9. Issue Specific Action Item Log (ISAIL)
    a. ICAT will check out and download the ISAIL to update as needed
        i. ICAT will create links to documents within Windchill® on the Info Docs page of the ISAIL
    b. ICAT can create action items for stakeholders through Windchill®
        i. Windchill® sends an email to the tasked user when ICAT creates an action item for them

10. Team Action Item Log
    a. ICAT will check out and download the TAIL to update as needed
        i. ICAT can create action items for team members through Windchill®
        ii. Windchill® sends an email to the tasked member when ICAT creates an action item in Windchill®

11. Meeting Sign-In
    a. ICAT will upload a scanned copy of the meeting sign-in sheet following the meeting
        i. The scanned copy of the sign-in sheet is for digital historical reference

12. Meeting Minutes
    a. ICAT will upload and Review route the meeting minutes to the attendees of the meeting
        i. Review routing will ensure that the stakeholders have reviewed the minutes for accuracy

13. Meeting Agenda
    a. Prior to the meeting, ICAT will Review route the meeting agenda to all attendees of the meeting

14. Meeting Prep Checklist
    a. The meeting preparation checklist will be available on an ICAP homepage in Windchill®.

15. Status Update
    a. ICAT will Notify route the status updates to the necessary stakeholders.
        i. Notify routing informs the stakeholders of new or changed documents.

16. Gathered Data
    a. ICAT will upload and store the data that they gathered into the gathered data folder in Windchill®.

17. Engineering Report
    a. ICAT will upload into Windchill® and Notify route the engineering report to the necessary stakeholders.

18. Executive Summary
    a. ICAT will upload into Windchill® and Notify route the executive summary to the necessary stakeholders.

19. Boundary Report
    a. ICAT will upload into Windchill® and Notify route the boundary report to the necessary stakeholders.

20. Gap Analysis
    a. ICAT will upload into Windchill® and Notify route the gap analysis to the necessary stakeholders.
21. Solution Implementation Package
    a. ICAT will upload into Windchill® and Notify route the solution implementation package to the necessary stakeholders.

ICAT will receive issue claims in the same manner as currently (i.e. Phone, Face to Face, Email, etc.) until ICAP's Windchill® is fully tailored with workflows. Once Windchill® is fully tailored, an issue initiator will access ICAT's Windchill® portal and upload all required information for issue initiation on a prompt screen. Once the required fields are complete, Windchill® will forward the document on to the ICAT. During the transition, ICAT may need to contact the issue initiator for more information concerning the issue. The issue initiator will also be able to upload reference material into Windchill®. During the beginning phases of transition toward the use of Windchill®, ICAT will rely on the Advanced Collaborative Environments (ACE) team to start a new project. An appointed member of the ICAT will be learning how to create a new project and how to handle issues that arise during the transition. The ACE team will create the project from a template that was previously developed. The new project will be in the define phase and the team lead or designated will have to upload the required documents and add Point of Contact (POC) to the contact list within Windchill®.

ICAT will begin their work on the preliminary Cause & Effect and Plan of Attack (PoA). ICAT will update the Master Indexing Matrix that is available to all on the ICAT's Windchill® homepage. ICAT will upload the meeting sign-in sheet and meeting minutes as they become available prior to the facilitated meeting. ICAT will then Review route the meeting agenda to the stakeholders that are required to attend the meeting. ICAT will schedule the meeting through Windchill® and follow the ICAP as normal.

Following the facilitated meeting, the ICAP continues as planned regardless of the outcome of the issue. The key factors involved in the use of Windchill® are the checking out and downloading of documents for updating and checking them in after completion. When ICAT obtains new documents, the documents are uploaded into Windchill® and stored in the appropriate location.

When an issue has reached the point of closure, then the ICAT will set the process status in Windchill® to "closed", which prevents all users from making additional changes. If ICAT needs to make changes, then the Windchill® project administrator will have to set the project to "run" so that the changes can be made.

Identified Deficiencies

1. ICAP does not have a ICAP Windchill® homepage
2. ICAP does not have a way for issue initiators to contact the ICAT without word of mouth.
3. ICAT does not have a head Windchill® project developer
4. ICAP does not have a Windchill® project template.
5. ICAT members do not have Windchill® access.
6. Stakeholders do not have Windchill® access.
7. ICAT and Stakeholders do not know how to use Windchill®.
8. There is no way of obtaining immediate directions without contacting the ICAT first for issue initiation.
9. ICAT has issues that are currently store in the team share folder.

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GLOSSARY of ACRONYNOMS

AKO: Army Knowledge Online

ALT: Acquisition, Logistics, and Technology

APM: Assistant Project Manager

ARDEC: Armaments Research Development & Engineering Center

BNVA: Business Non-Value-Added

CAD: Computer Aided Design

CDOV: Concept, Design, Optimize, Verify

DMAIC: Design, Measure, Analyze, Improve, Control

FMECA: Failure Mode Effect Critically Analysis

ICA: Integrated Corrective Action

ICAP: Integrated Corrective Action Process

ICAT: Integrated Corrective Action Team

ISAIL: Issue Specific Action Item Log

LCMC: Life Cycle Management Command

LSS: Lean Six Sigma

NSC: Natick Soldier Center

NVA: Non-Value-Added

PEO CS&CSS: Program Executive Office Combat Support & Combat Service Support

PEO GCS: Program Executive Office Ground Combat Systems

PEO Soldier: Program Executive Office Soldier

PM: Project Manager: "is the person who has the overall responsibility for the successful planning and execution of any project."

PoA: Plan of Attack: "ideas or actions intended to deal with a problem or situation."

PoA&M: Plan of Attack and Milestones

POC: Point of Contact

PTC: Parametric Technology Corporation

RACI: Responsible, Accountable, Consult, Inform

RPN: Risk Priority Number

SIPOC: Suppliers, Inputs, Process, Outputs, Customers

SME: Subject Matter Experts

SOP: Standard Operating Procedures

TACOM: Tank-Automotive & Armaments Command

TARDEC: Tank-Automotive Research, Development & Engineering Center

U.S.:   United States

VA: Value Added

APPENDICES

APPENDIX A

CDOV

Concept Development → **Design Development** → **Optimize Design** → **Verify Capability**

Concept Development
- POA&M
- Process Observation
- Critical Functions
- Program Plan
- Design Requirements

Design Development
- Benchmark Report
- SIPOC
- As-Is and To-be Swim-lane Flow Chart
- As-Is and To-be Value Stream Analysis
- Cause & Effect
- 5 Whys
- FMECA

Optimize Design
- Deficiency identification & plan

Verify Capability
- Process Analysis

APPENDIX B

PLAN OF ATTACK

Plan of Attack

Integrated Corrective Action Process Phase D Interactive Database

The goal of this project is to perform a gap analysis between the Integrated Corrective Action Process (ICAP) and Windchill®. Resulting from this analysis will be conclusions and recommendations on the implementation of the program. This plan of attach will consist of three phases leading to the completion of the project.

Phase I – Project Defining

- Task I: What is a Gap Analysis

    - Task I will be completed by learning Lean Six Sigma methodology to acquire the necessary tools. Once the proper tools are identified they can then be defined and an execution plan can be developed.

- Task II: What is the ICAP

    - Task II will be completed by researching and physically aiding the ICAP team. Researching will be conducted on the share drive where issue documentation is stored in an ICA team's specified folder structure.

- Task III: What is Windchill®

    - Task III will be completed by researching and defining the capabilities of Windchill® with the help of the ACE Team for support.

Phase II – Performing the gap analysis

- Task IV: Lean Six Sigma Tools

    o Task IV will be completed by developing and performing each Lean Six

    Sigma tool identified

- Task V: Analysis

    o Task V will be completed by comparing the tools used on the ICAP with

    the tools used on Windchill® and reporting the similarities and differences

    between facilitation, tracking, and the storing of documentation.

Phase III – Conclusion and Recommendations

- Task VI : Conclusion

    o Task VI will be completed by summarizing the differences between the

    ICAP and Windchill®.

- Task VII: Recommendation

    o Task VII will be completed by developing an implementation plan that

    removes critical differences and gives a smooth transition toward the use

    of Windchill® during the ICAP.

APPENDIX C

CRITICAL FUNCTIONS

- The database must be accessible to all persons involved in an issue

  - Persons include

    - ICAT

    - Stakeholders

- The database must be dependable

  - Low server error

  - Zero loss of information

- Easy upload of information

  - Minimal steps required

  - Information destination obvious to user

- The database must be searchable

  - Information must be easily obtainable by

    - ICAT

    - Stakeholders

- The database must give current status of all issues

  - Notify when an item is behind schedule

    - Single email when multiple items are behind

- The database must archive information indefinitely

  - Stored on database server

  - Inability to change, add or remove information in an issue

    - After a set period of time

- Only by the Windchill® administrator
  - Keep iterations indefinitely
  - Off loaded from database server to an "archiving devise"
  - Redundant backups

- Windchill® Manager
  - The administrator
    - Has full rights to all items within Windchill®
  - Add users to Windchill®

APPENDIX D

PROJECT PLAN

Project Plan

The project is to perform a gap analysis between ICAP and Windchill® which will identify the problems that may occur during the transition to an online collaborative database. To guide the project, the CDOV approach is used, which includes various tools from the Lean Six Sigma methodology. Upon completion of the analysis, deficiencies will be identified and recommendation will be given.

- CDOV

    Concept

    6. Plan of Attack & Milestones (POA&M)

    7. Project Plan

    8. Process Observation

    9. Critical Functions

    10. Design Requirements

    Design

    5. Benchmark Report

    6. As-Is and To-Be

        a. Suppliers, Inputs, Process, Outputs, Customers (SIPOC)

        b. Swim-lane Flow Chart

        c. Value Stream Analysis

    7. Cause & Effect with the "5 Whys"

    8. Failure Mode Effect Criticality Analysis (FMECA)

    Optimize

3. Critical- to-quality requirements

4. Deficiency identification & plan

Verify

1. Process Analysis

APPENDIX E

DESIGN REQUIREMENTS

Design Requirements

- The design

  - Must be adaptable to different anomalies, issues, and projects

  - Must take each ICAP step into account

- Workflows designed to simplify the process

  - Reduce time and resources, start to finish

  - Reduce burden on ICAT

- Easy upload of information

  - Multiple steps should be avoided

  - Information destination obvious to user

    - Auto save location for different document types

- Information within Windchill® must be obtainable

  - Upon request

  - Minimal effort required

  - Auto tagging for future searching of documentation

- Document controller

  - Prompt screen for document creating

    - Via online template

- Layers

  - Master documents

  - User specific view, read, and write capabilities

APPENDIX F

AS-IS and TO-BE SIPOC

SIPOC As-Is				
Suppliers	Inputs	Process	Outputs	Customers
Issue Initiator	Issue Initiator Controlled Source 　　Email 　　Phone Call 　　Face to Face 　　Briefing	Issue Initiation	Documents developed from templates located in the T: drive stored "Documents"	Issue Initiator
Research Requestor	Emails	Issue Vetting	Emails stored in "email"	Research Requestor
Stakeholders	Tech Manuals	Solution Development	Tech Manuals stored in "Info Gathered"	Stakeholders
ICAT	Technical Data	Solution Implementation	Technical Data stored in "Info Gathered"	ICAT
	Engineering Solutions	Corrective Action Status	Engineering Solutions stored in "Info Gathered"	
	Documents developed from templates located in the T: drive		Phone Calls stored in "Meeting Minutes"	
	Phone Calls		Face to Face Collaborating stored in "Meeting Minutes"	
	Face to Face Collaborating		Briefings stored in "Meeting Minutes"	
	Briefings		ISAIL : Located in the issue folder and is updated as information and documents come in	
			Research stored in "Info Gathered" or in a separate folder if the information is not as relevent but may be needed	

SIPOC To-Be				
Suppliers	Inputs	Process	Outputs	Customers
Issue Initiator	Issue Initiator Controlled Source Email Phone Call Face to Face Briefing	Issue Initiation	Issue Initiator documentation is stored in "1.0 Claim of Issue" or "2.1 Review Issue" depending on issue status	Issue Initiator
Research Requestor	Emails	Issue Vetting	Email will be transferred to a disscussion board	Research Requestor
Stakeholders	Tech Manuals	Solution Development	Tech Manuels and Technical Data will be stored in the approate porcess block folder	Stakeholders
ICAT	Technical Data	Solution Implementation	Engineering Solutions will be stored under "2.4 Solution Development"	ICAT
	Engineering Solutions	Corrective Action Status	Documents from templates will be stored in the appropriate folders	
	Documents developed from templates located in the T: drive		Phone Calls and Face to Face Discussion will be documented and stored in the appropriate folders	
	Phone Calls		Briefings will be documented and stored in the appropriate folders	
	Face to Face Collaborating			
	Briefings			

APPENDIX G

AS-IS SWIM LANE FLOW CHART, VALUE STREAM ANALYSIS and RACI

1.0 Claim of Issue

1.1 Scrub Brief

As-Is Swim-Lane Flowchart

Process boxes:

- Check for required elements
- Send to ICA Team
- Return brief to I2 if any information is missing
- 1. Gather data 2. Analyze data 3. List assumptions 4. Create a briefing package
- Enter information into database (initiate tracking)
- Email tracking number to I2
- Issue Initiator
- Identify correct SMEs for meeting
- Create folder and structure
- Store
- Identify preliminary tasks and questions
- Define meeting agenda
- Schedule room for # of people (and AV requirements)
- Email invitation to meeting with agenda and scrubbed pre-brief with key questions/request for papers
- Stakeholders

Swim lanes / rows:

- ICAT & ICAP Server Database, T. Drive
- Communication (Briefing, Email, Phone Call, Face to Face)
- Stakeholders
- Issue Initiator

Category	V A	B N V A	V A	B N V A	N B V A / V N A / A	B N V A	N B V A	N V A
		8		8	3	3		1
					8 1			0
NVA		8		8				1
BNVA		0.3		0	11	1	2	
VA		0.3		0	1			0

Number of People Involved: 2-12 @ 37.00 @ 1-2 hours 1-13 @ 45.00 @ 1 hour = $193.00 UNLOAD

Role	
Responsible	Issue Initiator, ICAT / ICAT
Accountable	Issue Initiator / ICA Team Lead
Consult	I2's Boss, ICA Team Lead / ICA Team Lead
Inform	ICA Team, PM Chief Engineer / Issue Initiator

As-Is Swim-Lane Flowchart

1.2 Facilitate Meeting

Row	Steps
ICAT & ICAP Server Database, T: Drive	Ascertain that all invited can attend and facilitate meeting → Take minutes → Present all information, discuss → Fact-based decision to research the issue further or close it → Record actions
Communication (Briefing, Email, Phone Call, Face to Face)	Reply; Email minutes and action items out after meeting
Stakeholders	Reply; Stakeholders
Issue Initiator	

VA / NVA / BNVA counts:
- NVA: 0, 1, 4, 0
- BNVA: 1, 1
- VA: 1, 1

1-12 @ 37.00 @ 1 hour
6-13 @ 45.00 @ 1 hour
2-14 @ 52.00 @ 1 hour
1-15 @ 61.00 @ 1 hour
= $731.00 UNLOAD

Responsible: ICA Team
Accountable: ICA Team Lead
Consult: ICA Team Lead
Inform: Issue Initiator

1.3 Define Action Plan

Row	Steps
ICAT & ICAP Server Database, T: Drive	Study brief, minutes, action log (start this at scrub pre-brief) → Determine what sources remain to be tapped → Develop plan/timeline and schedule resources → Finalize plan based on responses → Store → Save final plan in folder structure
Communication (Briefing, Email, Phone Call, Face to Face)	Email draft plan to PM Chief Engineer and ICA Team Lead for changes/concurrence; Reply; Email final plan
Stakeholders	Stakeholders; Stakeholders

VA / NVA / BNVA counts:
- NVA: 8, 3, 0, 2
- BNVA: 1, 3
- VA: 0, 0

1-12 @ 37.00 @ 8 hours
1-13 @ 45.00 @ 1 hour
1-14 @ 52.00 @ 1 hour
= $393.00

Responsible: ICA Team
Accountable: ICA Team Lead
Consult: ICA Team Lead
Inform: Issue Initiator

As-Is Swim-Lane Flowchart

1.4 Gather Information

1.5 Analyze Information

Process boxes (with VA values):
- Review action plan — 4
- Review contact check sheets — 2
- Review action item logs – get inputs required — 8
- Collect input / data — 16
- Analyze Data — 56
- Initiate contact with identified sources (SME etc) — 0
- Reply — 0
- Prepare information in suitable format for electronic archival and enter into database — 8
- Send weekly updates — 2
- Email notification sent — 0
- Stakeholders

Swim lanes:
- ICAT & ICAP Server Database, T: Drive
- Communication (Briefing, Email, Phone Call, Face to Face)
- Stakeholders
- Issue Initiator
- NVA
- BNVA
- VA

VA	4	2	8	0	24	2	56

Number of People Involved:

2-12 @ 37.00 @ 40-80 hours
5-13 @ 45.00 @ 1 hour
=$6145.00 UNLOAD

2-12 @ 37.00 @ 40-80 hours
5-13 @ 45.00 @ 1 hour
=$6145.00
DO NOT RE ADD - CONCURRENT IN 1.4

	1.4	1.5
Responsible	ICA Team	ICA Team
Accountable	ICA Team Lead	ICA Team Lead
Consult	ICA Team Lead	ICA Team Lead
Inform	Issue Initiator	Issue Initiator

1.6 Generate Engineering Report

1.7 Document Evidence

As-Is Swim-Lane Flowchart							

ICAT & ICAP Server Database, T: Drive

- Write a draft (8)
- Incorporate responses/recommendations from emailed draft (8)
- Write final report (6)
- Gather all information, evidence, and reports, etc used in previous steps (8)
- Prepare necessary items in electronic format (2)
- Post within file structure (2)
- Insert proper links into tracking database (1)

Communication (Briefing, Email, Phone Call, Face to Face)

- Email draft to PM Chief Engineer and ICA Team Lead (0)
- Reply (0)
- Email final report – with return receipt / receipt of read (0)
- Reply (1)
- Save responses email in file (1)

Stakeholders

- Stakeholders
- Stakeholders

Issue Initiator

	B V A	B N V A	V A	B N V A	V A	N V A	N V A	V A
NVA	8	8		1		8	2	1
BNVA	0	0		0				
VA	0	0	6	0				

Number of People Involved

1-12 @ 37.00 @ 4-8 hours
1-13 @ 45.00 @ 2 hours
1-14 @ 52.00 @ 2 hours
=$393.00

1-12 @ 37.00 @ 4-8 hours
=$296.00

Responsible	ICA Team	ICA Team
Accountable	ICA Team Lead	ICA Team Lead
Consult	ICA Team Lead	ICA Team Lead
Inform	Issue Initiator	Issue Initiator

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2.0 PM On-Switch 2.1 Review Issue

As-Is Swim-Lane Flowchart									

ICAT & ICAP Server Database, T: Drive
- Check for required elements
- Gather data
- Analyze data
- Create a briefing package for 2.2 boundary meeting
- Define meeting agenda
- Enter information into database (initiate tracking)
- Email tracking number to Research Requestor (R2)
- Create folder and structure in ICAT folder on T drive

Communication (Briefing, Email, Phone Call, Face to Face)
- Send to ICA Team
- Return brief to I2 if any information is missing
- Enter information into database (initiate tracking)
- Email tracking number to I2

Stakeholders
- Issue Initiator
- R2

Issue Initiator
1. Gather data
2. Analyze data
3. List assumptions
4. Create a briefing package

		NVA	BNVA	VA
				8
		8		8
				8
			2	6
			1	2

Enter information into database (initiate tracking): 8
Email tracking number to I2: 0
Create a briefing package for 2.2 boundary meeting: 8
Enter information into database (initiate tracking): 2
Email tracking number to Research Requestor (R2): 0
Create folder and structure in ICAT folder on T drive: 1

Number of People Involved: 1-12 @ 37.00 @ 2-3 days

Responsible	Research Requestor, ICAT	ICAT
Accountable	Research Requestor	ICAT Lead
Consult	R2's Boss, ICA Team Lead	Issue Dependent
Inform	ICAT, PM Engineers, PM Management	Research Requestor

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2.2 Facilitated Boundary Development Meeting

2.3 Generate Boundary Report

Process flow (2.2): Ascertain that all invited can attend → Ensure meeting checklist is complete → Hold Meeting → Make an outline using meeting minutes

- Record meeting minutes and action items
- Email minutes and actions out after meeting → Stakeholders

Process flow (2.3): Write a draft → Incorporate responses/recommendations from emailed draft → Write final report → Set up meeting if necessary (road block identified)

- Store → Email draft to ICA Team
- Store → Email final report to Progress Distribution List → Stakeholders
- Save response emails in file → Respond → Stakeholders

ICAT & ICAP Server Database, T: Drive	B N V A	B N V A	B N V A	B N V A	B N V A	B N V A	B N V A	N V A	B N V A
	8	4	4	4	4	6	6	8	
NVA	8	2	3	4	5	4	1	1	
BNVA			3	3	1	1	0	6	
VA				3	0	0	0		

Number of People Involved (2.2):
1-12 @ 37.00 @ 2.5 hours
6-13 @ 45.00 @ 1 hour
2-14 @ 52.00 @ 1 hour
1-15 @ 61.00 @ 1 hour
= $731.00 UNLOAD

Number of People Involved (2.3):
1-12 @ 37.00 @ 4-8 hours
1-13 @ 45.00 @ 2 hours
1-14 @ 52.00 @ 2 hours

Responsible	ICAT / ICAT
Accountable	Issue Accountable: PM C. Engineer, PM Facilitation / ICAT Lead
Consult	All meeting Attendees, Research Requestor
Inform	PM Management TARDEC Management / All meeting attendees

2.4 Solution Development   2.5 Scrub Solution

As-Is Swim-Lane Flowchart				

ICAT & ICAP Server Database, T: Drive
- Develop Boundary Report
- Set up meeting if necessary (road block identified)
- Gap Analysis Report
- Create/Fill out decision matrix template to analyze options

Communication (Briefing, Email, Phone Call, Face to Face)
- Send Boundary Report to PM/wSM, CC: responsible research team/POC
- Email
- ICAT tracks and records updates
- ICAT distributes updates
- Email
- Solution Details from the Solution Developer
- Ascertain information is in database

Stakeholders
- Stakeholders
- "responsible organization/team" performs research / testing
- Researcher(s) send weekly updates to ICAT for distribution
- Stakeholders

Issue Initiator

	VA	VA	B N VA	B VA N VA	B N VA	N VA	VA	N VA
VA/NVA values	8							
				0		8	8	2
		0		1	4			

	NVA	BNVA	VA
(col group 1)			8
(col group 2)		1	0
(col group 3)		4	0
(col group 4)	8		8
(col group 5)	6		

Number of People Involved
- 1-12 @ 37.00 @ 8 hours
- 1-13 @ 45.00 @ 1 hour

Responsible	ICAT (track/facilitate) — ICAT
Accountable	PM (set boundaries), Solution Developer (SD) — ICAT
Consult	PM POC, SD — SME, PM, TARDEC Engineers, SD
Inform	all meeting attendees, PM C. Engineer, Progress Distribution List — R2, PM Management

2.6 Solution Implementatoin Package Approval

As-Is Swim-Lane Flowchart

	B N V A	N V A	B N V A	B N V A	B N V A	V A	B N V A

ICAT & ICAP Server Database, T: Drive

- Implementation Plan, Gap Analysis Report, SD details
- Verify any changes that are required/needed by the PM/wSM or "owner"
- Decision Block 2.6.1 Determine if PM/wSM will implement the Solution that was developed
- If no, document why, return to phase A.1.8 for documentation and end process (data entered into historical data base)
- If yes, Decision block 2.6.2 determine if PM/wSM wants ICAP to track through implementation
- If no, document why, return to phase A.1.8 for documentation and end process (data entered into historical database)
- If yes, track implementation to closure, at project completion, return to phase A.1.8 and close issue.

Communication (Briefing, Email, Phone Call, Face to Face)

- Email → PM/wSM
- Respond
- Email → PM/wSM
- Respond

Stakeholders

Issue Initiator

	B N V A	N V A	B N V A	B N V A	B N V A	V A	B N V A
NVA		4					
BNVA	4		4	4	4		4
VA		0	0	0	0	0	

Number of People Involved

1-12 @ 37.00 @ 8 hours
1-13 @ 45.00 @ 1 hour
1-14 @ 52.00 @ 1 hour

Responsible	ICAT
Accountable	PM
Consult	SME, TARDEC Engineers
Inform	R2, PM, TARDEC Management

As-Is Swim-Lane Flowchart

2.7 Track through Implementation | 2.8 Document History | 1.8 Close Issue

	2.7 Track through Implementation	2.8 Document History	1.8 Close Issue	
	BNVA / VA	VA	BNVA / VA	VA / BNVA / VA
ICAT & ICAP Server Database, T: Drive	Gather updates from POC (as defined by PMW/SM during 2.2 meeting) — 8		Draft an email with Executive Summary — 4	Incorporate responses from lead and chief engineer(s) — 4
	Enter updates into data base / tracking system — 8	Document event occurrence in master index log and action specific logs — 8	Link to the tracking database – in email — 0	
Communication (Briefing, Email, Phone Call, Face to Face)	Email updates to team members — 0		Send email to ICA Team Lead and PM Chief Engineer(s) — 0	Respond — 0
Stakeholders			Stakeholders — 0	Send final email — 0
Issue Initiator				Stakeholders — 0
NVA				
BNVA	8		4	4
VA	8	8	0	0
Number of People Involved	1-12 @ 37.00 @ 8 hours	1-12 @ 37.00 @ 1 hour	1-12 @ 37.00 @ 2 hours 1-13 @ 45.00 @ 1 hour 1-14 @ 52.00 @ 1 hour =$171.00	
Responsible	ICAT/P	ICAT	ICA Team	
Accountable	PM POC	ICAT	ICA Team Lead	
Consult	PM POC	Others (see 2.2)	ICA Team Lead	
Inform	Others (see 2.2)	Others (see 2.2)	Issue Initiator	

APPENDIX H

TO-BE SWIM LANE FLOW CHART, VALUE STREAM ANALYSIS and RACI

To-Be Swim-Lane Flowchart

1.0 Claim of Issue   1.1 Scrub Brief

Swim-lane flowchart with the following lanes and process steps:

ICAT & Windchill Program
- Check for required elements
- Contact ACE to initiate new project
- Identify correct SMEs for meeting
- Identify preliminary tasks and questions
- Define meeting agenda
- Schedule room for # of people (and AV requirements)

ACE
- Create project
- Email invite project to ICAT and i2
- Login to Windchill and enter information into database (initiate tracking)
- Setup meeting

Windchill
- Add to Windchill as stakeholders
- Store
- Email invite to project
- Send invite with link to relevant documents and information

Communication (Briefing, Email, Phone Call, Face to Face)
- Send to ICA Team
- Return brief tail2 if any information is missing

Stakeholders
- Stakeholders
- Stakeholders

Issue Initiator
- 1. Gather data 2. Analyze data 3. List assumptions 4. Create a briefing package
- Issue Initiator

	VA	BNVA	BNVA	BNVA	BNVA	BNVA	BNVA	NVA
NVA total		0	1		0			1
BNVA total		1		4	12	1	5	
VA total			1		0	2	2	0

Column box numbers: 0 · 0 · 1 · 8 · 4 · 0 · 3 / 2 · 2 · 1

Number of People Involved: 2-12 @ 37.00 @ 1-2 hours; 1-13 @ 45.00 @ 1 hour

Responsible	Issue Initiator, ICAT	ICAT and ACE is responsible for creating the project
Accountable	Issue Initiator	ICA Team Lead
Consult	I2's Boss, ICA Team Lead	ICA Team Lead
Inform	ICA Team, PM Chief Engineer	Issue Initiator

1.2 Facilitate Meeting   1.3 Define Action Plan

To-Be Swim-Lane Flowchart

ICAT & Windchill Program
- Ascertain that all invited can attend and facilitate meeting (4)
- Take minutes (1)
- Present all information, discuss (1)
- Fast-tracked decision to research the issue further or close it (1)
- Study brief, minutes, action log (start this at scrub pre-brief) (0)
- Determine what resources remain to be tapped (1)
- Develop plan/timeline and schedule resources (1)
- Finalize plan based on response (2)

ACE
- Store (1)
- Save final plan (1)

Windchill
- Email notification sent to inform those who have subscribed
- Record actions and add newly identified stakeholders to file (4)
- Email notification sent to new stakeholders
- Email notification sent to PM Chief Engineer and ICA Team Lead on availability for change of concurrence
- Email notification sent on final plan availability

Communication (Briefing, Email, Phone Call, Face to Face)

Stakeholders
- Reply
- Stakeholders
- Stakeholders
- Email notification sent
- Reply
- Stakeholders

Issue Initiator

	NVA total	BNVA total	VA total
(1.2)	4	1	1
	0	4	0
	8	1	3
(1.3)	3	1	0
	2	1	0

Number of People Involved

1-12 @ 37.00 @ 1 hour
6-13 @ 45.00 @ 1 hour
2-14 @ 52.00 @ 1 hour
1-15 @ 61.00 @ 1 hour

1-12 @ 37.00 @ 8 hours
1-13 @ 45.00 @ 1 hour
1-14 @ 52.00 @ 1 hour

Responsible	ICA Team
Accountable	ICA Team Lead
Consult	ICA Team Lead
Inform	Issue Initiator

To-Be Swim-Lane Flowchart

1.4 Gather Information | 1.5 Analyze Information | 1.6 Generate Engineering Report

ICAT & Windchill Program
- Review action plan
- Review contact checksheets
- Review action item log – get input required
- Collect input data
- Analyze Data
- Make an outline
- Write a draft
- Incorporate responses/comments/obtain from draft
- Write final report

ACE
- Initiate contact with identified source (SME etc.)
- Prepare information in suitable format for electronic archival and Enterprise database
- Send weekly update – or time required
- Store and route to need to know stakeholders (Write a draft)
- Store and route to need to know stakeholders (Write final report)

Windchill
- Send notification email
- Send notification email
- Email notification sent
- Send notification email (1.6 Write a draft)
- Send notification email (Incorporate responses)
- Send notification email (Write final report)

Communication (Briefing, Email, Phone Call, Face to Face)

Stakeholders
- Reply
- Stakeholders
- Stakeholders
- Stakeholders
- Reply
- Stakeholders
- Reply

Issue Initiator

	Review action plan V/A	Review contact checksheets V/A	Review action item log V/A	V/A	Collect input data V/A	V/A	Analyze Data V/A	Make an outline N/V/A	Write a draft BN/V/A	BN/V/A	Incorporate BN/V/A	Write final report BN/V/A	V/A	V/A
	4		2	8	16		56	1	8	8		8	6	
				0		2					0		0	
NVA total								1						
BNVA total									8	8		8		
VA total	4		2	8	24	0	56						6	0

Number of People Involved
- 1.4 Gather Information: 2-12 @ 37.00 @ 40-80 hours; 5-13 @ 45.00 @ 1 hour
- 1.5 Analyze Information: 2-12 @ 37.00 @ 40-80 hours; 5-13 @ 45.00 @ 1 hour — DO NOT RE-ADD – CONCURRENT IM 1.4
- 1.6 Generate Engineering Report: 1-12 @ 37.00 @ 4-8 hours; 1-13 @ 45.00 @ 2 hours; 1-14 @ 52.00 @ 2 hours

	1.4	1.5	1.6
Responsible	ICA Team	ICA Team	ICA Team
Accountable	ICA Team Lead	ICA Team Lead	ICA Team Lead
Consult	ICA Team Lead	ICA Team Lead	ICA Team Lead
Inform	Issue Initiator	Issue Initiator	Issue Initiator

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To-Be Swim-Lane Flowchart

1.7 Document Evidence | 2.0 PM On-Switch | 2.1 Review Issue

Lane	1.7 Document Evidence	2.0 PM On-Switch	2.1 Review Issue
ICAT & Windchill Program	Gather all information, evidence, and reports, etc. used in previous steps (NVA, =8); Prepare necessary items in electronic format (NVA, =2)	Send to ICA Team (=2); Check for required elements; Contact ACE to initiate new project (BNVA, =0)	Gather data (VA, =8); Analyze data (VA, =8); Create a briefing package for 2.2 boundary meeting (VA, =4); Define meeting agenda (VA, =2)
ACE	Store	Create project	Create meeting
Windchill		Return briefing to R2 if any information is missing; Email invite to project to ICAT and R2; Log in to Windchill and enter information into database (initiate tracking)	Email notification sent
Communication (Briefing, Email, Phone Call, Face to Face)		1. Gather data 2. Analyze data 3. List assumptions 4. Create a briefing package	
Stakeholders		Research Requestor	Stakeholders
Issue Initiator			

Value totals

	1.7 Document Evidence	2.0 PM On-Switch	2.1 Review Issue
NVA total	8, 2	2	
BNVA total		0	
VA total		0, 0, 0, 0, 1	8, 8, 6, 2

RACI

	1.7 Document Evidence	2.0 PM On-Switch	2.1 Review Issue
Number of People Involved	1-12 @ 37.00 @ 4-8 hours		1-12 @ 37.00 @ 2-3 days
Responsible	ICA Team	Research Requestor, ICAT	ICAT
Accountable	ICA Team Lead	Research Requestor	ICAT Lead
Consult	ICA Team Lead	R2's Boss, ICA Team Lead	Issue Dependent
Inform	Issue Initiator	ICAT, PM Engineers, PM Management	Research Requestor

2.2 Facilitated Boundary Development Meeting — 2.3 Generate Boundary Report (To-Be Swim-Lane Flowchart)

ICAT & Windchill Program
- Ascertain that all invited can attend (8)
- Ensure meeting checklist is complete (2)
- Hold Meeting (2)
- Make an outline using meeting minutes (3)
- Write a draft (4)
- Incorporate responses/recommendations from draft (4)
- Write final report (6)

ACE
- Record meeting minutes and action items and route to stakeholders (3)
- Store and route to ICAT for review and comments (1)
- Store and route to share on the Proper Distribution List (1)

Windchill
- Email notification sent (0)
- Email notification sent (0)
- Email notification sent (0)

Communication (Briefing, Email, Phone Call, Face to Face)

Stakeholders
- Stakeholders (3)
- Stakeholders (6)
- Respond (0)

Issue Initiator

	Ascertain	Ensure checklist	Hold Meeting	Make outline	Write a draft	Incorporate	Write final report
NVA total	8	2					
BMVA total		2	3		5		1
VA total			3	3	0	0	6

Number of People Involved

2.2:
- 1-12 @ 37.00 @ 2.5 hours
- 6-13 @ 45.00 @ 1 hour
- 2-14 @ 52.00 @ 1 hour
- 1-15 @ 61.00 @ 1 hour

2.3:
- 1-12 @ 37.00 @ 4-8 hours
- 1-13 @ 45.00 @ 2 hours
- 1-14 @ 52.00 @ 2 hours

Responsible: ICAT | ICAT

Accountable: Issue Accountable: PM C. Engineer, PM Facilitation | ICAT Lead

Consult: All meeting Attendees, Research Requestor

Inform: PM Management TARDEC Management | All meeting attendees

To-Be Swim-Lane Flowchart

2.4 Solution Development | 2.5 Scrub Solution

ICAT & Windchill Program
- Set up meeting if necessary (read black identified)
- Develop Boundary Report
- Monitor
- Develop update
- Gap Analysis Report
- Create/Fill out decision matrix template to analyze options

ACE
- Store and route
- Store and route
- Ascertain information in database

Windchill
- Email notification sent
- Track and record
- Email notification sent
- Email notification sent

Communication (Briefing, Email, Phone Call, Face to Face)

Stakeholders
- Stakeholders
- *responsible organization/team perform research /testing
- Stakeholders
- Solution Details from the Solution Developer

Issue Initiator

	NVA total	BNVA total	VA total
	6	1	6

Number of People Involved: 1-12 @ 37.00 @ 8 hours; 1-13 @ 45.00 @ 1 hour

Responsible	ICAT (track/facilitate)
Accountable	PM (set boundaries), Solution Developer (SD) / ICAT
Consult	PM POC, SD / SME, PM, TARDEC Engineers, SD
Inform	all meeting attendees, PMC. Engineer, Progress Distribution List / R2, PM Management

2.6 Solution Implementatoin Package Approval

To-Be Swim-Lane Flowchart						
ICAT & Windchill Program	Implementation Plan, Gap Analysis Report, SD details	Verify any changes that are required/touched by the PMWSM or "minor"	Decision Block 2.6.1 Determine if PMWSM will implement the Solution that was developed	If yes, Decision block 2.6.2 determine if PMWSM can track through ICAP to track through	If no, document why, return to phase A1.8 for documentation and end process (data entered into	If yes, track implementation to closure, et project completion, return to phase A1.8 and close issue.
ACE			Create discussion linked to the implementation package	Continue discussion that is linked to the Implementation package	If no, document why, return to phase A1.8 for documentation and end process (data entered into	
Windchill			Email notification sent	Email notification sent		
			PMWSM	PMWSM		
Communication (Briefing, Email, Phone Call, Face to Face)						
Stakeholders						
Issue Initiator						
NVA total		4	4	4	4	4
BNVA total	4			4		4
VA total			0	0	0	

Number of People Involved:
1-12 @ 37.00 @ 8 hours
1-13 @ 45.00 @ 1 hour
1-14 @ 52.00 @ 1 hour

Responsible	ICAT
Accountable	PM
Consult	SME, TARDEC Engineers
Inform	R2, PM, TARDEC Management

To-Be Swim-Lane Flowchart

	2.7 Track through Implementation	2.8 Document History	1.8 Close Issue
ICAT & Windchill Program	Gather updates from POC (as defined by PM/WSM during 2.2 meeting)	Draft an Executive Summary	Incorporate responses from lead and chief engineer(s)
ACE	Format update into data base/tracking system	Document event occurrence in master index log and action-specific log; Store and route to ICA Team Lead and PM Chief Engineer(s)	Store and route to ICA Team Lead and PM Chief Engineer(s)
Windchill	Email notifications to ICAT	Email notification sent	Email notification sent
Communication (Briefing, Email, Phone Call, Face to Face)			
Stakeholders		Stakeholders	Stakeholder / Respond / Stakeholders
Issue Initiator			
NVA total			
BNVA total	8	8	4
VA total	8	8 / 0	0 / 0 / 0
Number of People Involved	1-12 @ 37.00 @ 8 hours	1-12 @ 37.00 @ 1 hour	1-12 @ 37.00 @ 2 hours; 1-13 @ 45.00 @ 1 hour; 1-14 @ 52.00 @ 1 hour
Responsible	ICAT/P	ICAT	ICA Team
Accountable	PM POC	ICAT	ICA Team Lead
Consult	PM POC	Others (see 2.2)	ICA Team Lead
Inform	Others (see 2.2)	Others (see 2.2)	Issue Initiator

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APPENDIX I

CAUSE & EFFECT with THE "5 WHYS?"

Locate im

Process

Team is developing new folder structure

Server is down

User does not have an account

Unable to log into Windchill

Search function is difficult to utilize

User is not how to use

ICAT has nothing to update

ICAT has not set out the update

Item demanded instant action

Me

Unable to locate needed information in database

Authority is not granted to user in order to maintain control of database

User have not been required in the past to use Windchill

Weekly updates not received by Stakeholders

Status reports are available from the Windchill home page

User does not have authority

It is hard to categorize emails into process blocks

Team knows what to do next but does not know where they stand in process

ICAP is a newer process

Stakeholders not on Windchill's stakeholders list

Unable to upload documents into Windchill

Team is unclear where they stand in process

Users are unfamiliar with Windchill and/or the ICAP

Stakeholder does not have an ACE account

Documents do not get routed through Windchill

Information is stored in the wrong location in Windchill

Stakeholder has not been added to the project

Issues contain multiple items that belong to different areas of the process

Solutions may be developed prior to ICAT receiving

Stakeholder has not been required in the past to use Windchill

ICAT has not had the time

Stakeholder has just been identified

Users are unfamiliar with Windchill and/or the ICAP

Meeting not scheduled in Windchill

When groups are told to "do" they do.

ICAT only has a limited number of people

User have not been required in the past to use Windchill

Windchill does not indicate whether or not attendees are able to attend

Users are not familiar with Windchill and prefer their own method

Hiring is a slow process

Windchill is unable detect acceptance or decline of the meeting time

User have not been required in the past to use Windchill

Problem: ICAT needs a collaborative database accessible to all users

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Communication

No way to stop others from mov removing documentation

If access to all where granted ICAT would loss control of documentation tracking and facilitating

Information in T: drive is not available to others outside of ICAT

Stakeholders have not been required in the past to obtain an account

Stakeholders have not worked with Windchill in the past

Stakeholders do not have a ACE account

Stakeholders are not familiar with Windchill

ACE did not add stakeholder to project

Stakeholders do not receive invite to project email

Stakeholders are unaware that they are required to do so

Stakeholders do not reply as to their attendance

Stakeholders have not been required in the past to obtain an account

They do not have access to Windchill

Stakeholders have not worked with Windchill in the past

Stakeholders are not familiar with Windchill

PM Chief Engineer and ICA Team Leader are unable to make changes or concur with documents through Windchill

User has not completed the work

User has not obtained answers

User did not check work back in

User is unfamiliar with Windchill

Document was not routed

Email notification was not received

Issue Initiator and/or ICAT does not receive the invitation to the project

Recipient is not flagged to receive notification

Sender inadvertently did not flag the receiver

ACE did not add I2 or ICAT to project

I2 or ICAT does not have a ACE account

I2 or ICAT have not been required in the past to obtain an account

Answers to technical questions

User has not been required in the past to acquire an account

not trained on use Windchill

User has not been required in the past to use Windchill

Server lag or error

Email notification was not received in time to attend meeting

Recipient is out of the office

Meeting was set up on short notice

information

Emails build up with no time to upload

The is a lot of work to be done

Not enough team members

Information is not in database

ICAT did not upload the information

ACE Team is unable to build project in a timely manner

ACE has a high demand without the personal to cover

Information not entered into Windchill

ICAT has not had the time

ICAT only has a limited number of people

Hiring is a slow process

Work Place Environment

Team is having a hard time facilitating multiple issues

Not enough team members

It takes time to hire

One big issue takes over entire teams time

Stakeholders are not comfortable with Windchill

Stakeholders have not worked with Windchill in the past

Stakeholders do not reply through Windchill

ICAT does not send a weekly update through Windchill

ICAT is not familiar with Windchill's capabilities

ICAT has not been required in the past to use Windchill

ICAT does not store or route report through Windchill

Information does not get stored in Windchill

Issue Initiator is unwilling to work with Windchill

Stakeholders are not comfortable with Windchill

Stakeholders have not worked with Windchill in the past

I2 is not comfortable with Windchill

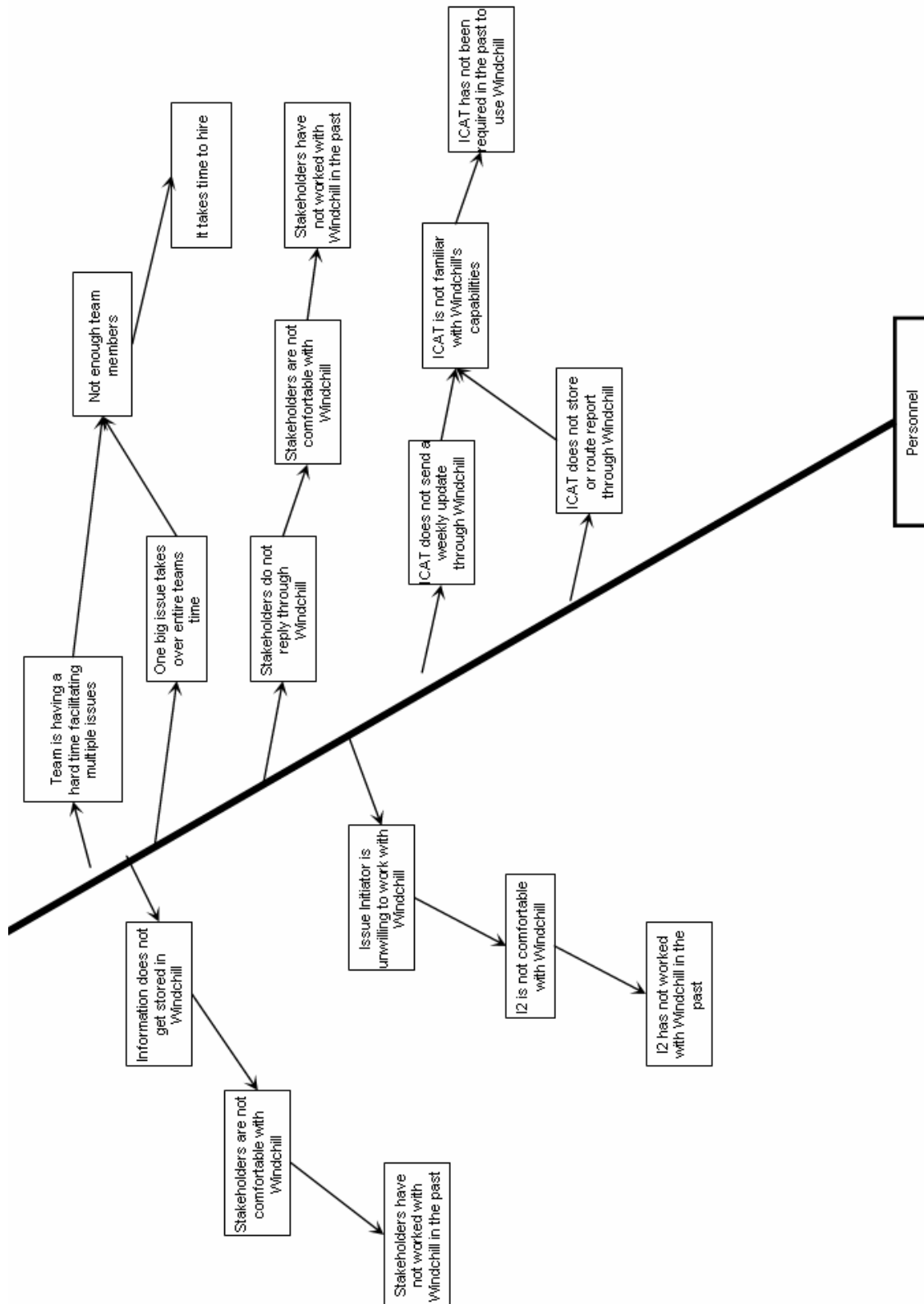I2 has not worked with Windchill in the past

Personnel

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APPENDIX J

FMECA

Process Step/Input	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes	OCC	Current Controls	DET	RPN	Criticality
2.5 Scrub Solution	Information is stored in the wrong place by the stakeholder	Information is lost	5	Stakeholder is not familiar with Windchill®	4	No current control	5	100	**critical 1**
		Resources are wasted on looking for the information		Stakeholder is not familiar with ICAP		No current control			
1.4 Gather Information	ICAT does not receive Stakeholder response notification	ICAT will view the stakeholders task as incomplete	5	Stakeholder did not check the work back in	3	No current control	5	75	**critical 1**
2.1 Review Issue	Stakeholder does not receive notification	Stakeholder will not know what they need to complete	5	Stakeholder is not available through Windchill®	2	No current control	5	50	**critical 1**
		Stakeholder's email address is not entered correctly into Windchill®		ACE entered email address incorrectly while creating stakeholders account		No control			
2.2 Facilitated Boundary Development Meeting	Stakeholder does not receive notification	Stakeholder will not know of what they need to complete	5	Stakeholder is not available through Windchill®	2	No current control	5	50	**critical 1**
		Stakeholder's email address is not entered correctly into Windchill®		ACE entered email address incorrectly while creating stakeholders account		No control			
2.3 Generate Boundary Report	Email notification was not received	Document does not get reviewed or completed	5	Stakeholder unavailable through Windchill	2	No current control	5	50	**critical 1**

Process	Failure Mode	Effect	Sev	Cause	Current Controls	Occ	Det	RPN	Criticality
				Stakeholder is not indicated through Windchill® as need to know	No current control				
2.4 Solution Development	Stakeholder does not receive notification	Stakeholder will not know of what they need to complete	5	Stakeholder is not available through Windchill®	No current control	2	5	50	**critical 1**
		Stakeholder's email address is not entered correctly into Windchill®		ACE entered email address incorrectly while creating stakeholders account	No control				
2.5 Scrub Solution	ICAT does not receive notification of information availability	ICAT will not be aware of the information	5	Stakeholder is not familiar with Windchill®	No current control	2	5	50	**critical 1**
2.6 Solution Implementation Package Approval	PM/WSM does not receive notification	PM/WSM does not complete their needed action	5	PM/WSM is not on the Windchill® Stakeholder list	No current control	2	5	50	**critical 1**
		Solution Implementation is delayed		ICAT did not opt for the PM/WSM to receive the documents	No current control				
				ICAT is unfamiliar with Windchill®	No current control				

2.7 Track through Implementation	Stakeholder does not receive notification	Stakeholder will not know of what they need to complete	5	Stakeholder is not available through Windchill®	No current control	5	50	**critical 1**
	Stakeholder's email address is not entered correctly into Windchill®			ACE entered email address incorrectly while creating stakeholders account	No control	2		
2.8 Document History	Stakeholder does not receive notification	Stakeholder will not know of what they need to complete	5	Stakeholder is not available through Windchill®	No current control	5	50	**critical 1**
	Stakeholder's email address is not entered correctly into Windchill®			ACE entered email address incorrectly while creating stakeholders account	No control	2		
1.8 Close Issue	Stakeholder does not receive notification	Stakeholder will not know of what they need to complete	5	Stakeholder is not available through Windchill®	No current control	5	50	**critical 1**
	Stakeholder's email address is not entered correctly into Windchill®			ACE entered email address incorrectly while creating stakeholders account	No control	2		
1.8 Close Issue	ICAT does not receive notification of information availability	ICAT will not be aware of the information	5	Stakeholder is not familiar with Windchill®	No current control	2	5	50	**critical 1**

Process	Potential Failure	Potential Effect	S	Potential Cause	O	Current Control	D	RPN	Criticality
1.7 Document Evidence	Unable to locate needed information from database	ICAT begins to keeps a separate database in the T: drive	5	Windchill®'s search capabilities are difficult to use	4	No current control	2	40	**critical 1**
		Resources wasted looking for information		Unknown folder location		ICAT has created a different folder structure within the T: drive			
		Windchill® becomes less favored and becomes useless							
2.5 Scrub Solution	Information is not in database	No one is able to obtain the needed information because they do not know where it is	5	ICAT or Stakeholder did not upload the information into the database	3	No current control	2	30	**critical 1**
1.0 Claim of Issue	Required information is not obtained to initiate issue vetting	ICAT is continually returning to the I2 for additional information	5	I2 does not have the information	2	ICAT aids in contacting the proper personal who has the information	2	20	**critical 1**
		Slows the process down		I2 forgot to include the information		No control			
				ICAT was not specific enough on what they where looking for		Current process ads in the development of what is needed			
				ICAT did not ask for the information		Current process sets requirements			

1.5 Analyze Information	Analysis does not get stored in Windchill®	Information will not be available in the future when archived	5	Easier to save information in T: drive then it is to upload into Windchill®	1	No current control	1	5	critical 1
1.1 Scrub Brief	Information gets stored in the wrong location in Windchill®	Information is lost	4	ICAT is unfamiliar with Windchill®	4	Store all documents and information in T: drive under issue specific folder structure	5	80	medium
		Only one employee knows where the information is and there is not a way to search for it		SOPs do not give direction on where to store information					
1.1 Scrub Brief	Information does not get stored in Windchill®	Information is lost	4	ICAT is unfamiliar with Windchill®	3	Store all documents and information in T: drive under issue specific folder structure	5	60	medium
		Only one employee knows where the information is and there is not a way to search for it		It is easier to store information in the T: drive then it is to upload into Windchill®		ICAT is currently trained to store in the T: drive which is accessible to all team members			

		Issue becomes destine to reemerge without proper record keeping		ICAT does not have enough man power to keep up with issues		Hiring is underway			
				ICAT has not had the time		Hiring is underway			
2.4 Solution Development	Research/testing team does not have access to Windchill®	Research/testing team might be delayed by waiting for needed information from ICAT	3	ACE has not created an account for the members of the team	4	No current control	5	60	medium
		Research/testing team might miss important information resulting in unneeded or wasted work		The team was not aware that they needed to obtain an Windchill® account		No current control			
2.1 Review Issue	Email notification was not received in time to attend meeting	Stakeholder may not be able to attend the meeting	4	Windchill® server lag	3	No control	4	48	medium
		Meeting may need to be postponed		Email notice sent on short notice by the ICAT team		Process is written so that stakeholders are not forced into short notice meeting			
		Project will be delayed		Stakeholder was out of office		No Control			
2.3 Generate Boundary Report	Stakeholder is unable to respond through Windchill®	Information does not get archived in Windchill® for future references	3	Stakeholders are not comfortable with Windchill®'s discussion	3	No current control	5	45	medium

				board					
		Issue life cycle information becomes incomplete		Stakeholder are not trained in the use and capabilities of Windchill®		No current control			
		ICAT utilities more resources to format and upload reply information into Windchill®							
2.5 Scrub Solution	Stakeholder is unable to store information in Windchill®	Stakeholder will email the information to ICAT for storage	3	Stakeholder does not have access to Windchill®	3	No current control	5	45	**medium**
		Storage of the information will not be in Windchill®		Stakeholder is not familiar with Windchill®		No current control			
1.1 Scrub Brief	Stakeholder does not receive invite to meeting	Important information will not be conveyed	4	Stakeholder is out of office	2	Meetings will not be short notice	5	40	**medium**
		Meeting may need to be postponed		Stakeholder was not added to list		Current process identifies key stakeholders			
				Stakeholder is not available on the Windchill® server		No current control			

Process	Potential Failure Mode	Potential Effect(s)		Potential Cause(s)	Current Controls			
				Stakeholders email address entered incorrectly	ICAT does its best to hire only responsible team members			
1.3 Define Action Plan	ICAT or Stakeholders do not receive email notification from Windchill®	Documents or action items do not get reviewed or completed	4	Document was not routed	No current control	2	5	40	**medium**
				Stakeholder unavailable through Windchill®	No current control			
1.6 Generate Engineering Report	Stakeholders do not receive email notification	Documents or action items do not get reviewed or completed	4	Document was not routed	No current control	2	5	40	**medium**
				Stakeholder unavailable through Windchill®	No current control			
2.0 PM On-Switch	Research Requestor and/or ICAT does not receive the invitation to the project	ICAT is forced to run the process manually	4	Lack of training and comfort with Windchill®	No current control	2	5	40	**medium**
1.8 Close Issue	Executive Summary does not get stored correctly	Stakeholder will not be able to locate it	4	ICAT is unfamiliar with Windchill®	No current control	2	5	40	**medium**
1.1 Scrub Brief	Stakeholders do not get added to Windchill® stakeholders list	Stakeholders will not be notified about document and information availability	3	ICAT does not know how to add stakeholders to a project	No current control	3	4	36	**medium**

	Stakeholders will not receive invites to the project			ICAT did not give ACE the names during project building		No current control			
				ICAT does not add names for fear of uncontrollable access to those users		Access to what other users are able to view or edit is up to the owner of the document			
				Stakeholder does not have an ACE account		No current control			
				Stakeholder has just been identified		No current control			
1.2 Facilitate Meeting	Stakeholders do not reply as to their attendance	Meeting can not be held	4	Windchill ® lacks a response function for when a meeting time is accepted	4	No current control	2	32	medium
1.1 Scrub Brief	Stakeholders do not receive invite email to project	Stakeholder will be unable to log in to complete tasks	3	Stakeholder's name did not get add to list	2	Current process identifies key stakeholders	5	30	medium
		Project will be delayed		ICAT did not complete the addition of the stakeholder		ICAT does its best to hire only responsible team members			
				Stakeholder is not available on the Windchill ® server		No current control			

Process Step	Failure Mode	Effect	Sev	Cause	Occ	Current Control	Det	RPN	Risk
1.6 Generate Engineering Report	ICAT does not receive Stakeholder response notification	ICAT will view the stakeholders task as incomplete	3	Stakeholder did not check the work back in	2	No current control	5	30	**medium**
1.4 Gather Information	Stakeholders do not respond through Windchill®	Stakeholder chooses a different way to respond and proper documentation of information does not occur	3	Stakeholders are not trained to use Windchill®	3	No current control	3	27	**medium**
1.4 Gather Information	Data collected does not get stored in Windchill®	Information is lost	4	Not enough ICAT members to handle the work load	3	Hiring is underway	2	24	**minor**
		Stakeholders will be unable to obtain what they need to complete their tasks		ICAT does not know how to upload data documents into Windchill®		No current control			
		Data will not be available for future reference should the problem arise again							
1.4 Gather Information	Stakeholders do not receive the weekly update	Stakeholders loses track of the status of an issue	3	Stakeholder's name is not uploaded into Windchill®	2	No current control	4	24	
		Stakeholders reinitiate a problem either on their own or to the ICAT because they feel no one		ICAT does not know how to utilize Windchill® to send update		No current control			**minor**

			is doing anything about it					
			ICAT did not tell Windchill® to send the update to all stakeholders		No current control			**minor**
1.2 Facilitate Meeting	Stakeholder does not get informed with need to know information	Stakeholder unable to fulfill action item	**4**	ICAT does not know how to upload documents containing information into Windchill®	**1**	No current control	**5**	**20**	**minor**
1.4 Gather Information	Stakeholder do not receive notification email	Documents or action items do not get reviewed or completed	**4**	Document was not routed	**1**	No current control	**5**	**20**	**minor**
				Stakeholder unavailable through Windchill®		No current control			
1.1 Scrub Brief	Unable to log in to Windchill®	Project will be delayed until log in is achieved or ICAT runs process manually	**3**	Windchill® access has not been obtained	**2**	No current control	**3**	**18**	**minor**
				User has forgotten password		User responsible			
				User does not have web link to Windchill® log in window		No current control			

Process	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Potential Cause(s)	Occ	Current Controls	Det	RPN	Rating
1.7 Document Evidence	ICAT does not know how or where to store information in Windchill®	ICAT resorts to storing information in the T: drive	3	It is easier to store information in the T: drive then it is to upload into Windchill®	3	No current control	2	18	**minor**
1.0 Claim of Issue	Issue Initiator and/or ICAT does not receive the invitation to the project	Project will be delayed until invitation is received or ICAT runs process manually		ACE was not given the names of the personal who are involved in the project		ICAT is responsible for providing ACE with the names and contact information when necessary			
		I2 by passes the ICAP and deals with issue on their own	3	ACE does not send invitation	2	ICAT will insure that the invitations have been received in a timely manner	2	12	**minor**
				ACE has not built project yet		We can not control the actions of ACE			
1.8 Close Issue	ICAT does not route the Executive Summary	Executive Summary does not get reviewed in a timely fashion	4	ICAT forgot to route the document	1	ICAT does its best to hire only responsible team members	3	12	**minor**
1.0 Claim of Issue	Issue Initiator is unwilling to work with Windchill®	ICAT is forced to run the process manually	3	Lack of training and comfort with Windchill®	3	No current control	1	9	**minor**

		Archival of problem will not be as complete for future reference		I2 does not have access to Windchill®		No current control			
1.3 Define Action Plan	PM Chief Engineer and ICA Team Leader are unable to make changes or concur with documents through Windchill®	Delay to the process	3	Unclear how Windchill®'s check in and out, and edit document system works	1	Windchill® has learning tabs for different areas as well as a searchable index	3	9	minor
1.8 Close Issue	Stakeholder does not respond to a document	Stakeholder chooses a different way to respond and proper documentation of information does not occur	3	Stakeholders are not trained to use Windchill®	3	No current control	1	9	minor
		Information does not get archived in Windchill® for future references		Stakeholders are not comfortable with Windchill®'s discussion board		No current control			
		Issue life cycle information becomes incomplete		Stakeholder are not trained in the use and capabilities of Windchill®		No current control			
		ICAT utilities more resources to format and upload reply information into Windchill®							

Process	Failure Mode	Effect	Sev	Cause	Occ	Current Control	Det	RPN	Result
2.0 PM On-Switch	Research Requestor is unwilling to work with Windchill®	Archival of problem will not be as complete for future reference	2	R2 does not have access to Windchill®	2	No current control	2	8	**minor**
				R2 is not comfortable with the usage of Windchill®		No current control			
1.4 Gather Information	Weekly updates not sent out	Stakeholders loss track of the status of an issue	2	Not enough ICAT members to handle the work load	3	Hiring is underway	1	6	**minor**
		Stakeholders reinitiate a problem either on their own or to the ICAT because they feel no one is doing anything about it		ICAT forgot to send updates		Process is written so that updates are sent out as needed			
1.4 Gather Information	ICAT does not send a weekly update through Windchill®	Stakeholders will receive an update via a different method	2	ICAT does not know how to utilize Windchill® to send update	3	No current control	1	6	**minor**
		Stakeholders do not receive an update		There is nothing to update		Procedure is written to send an update as needed			
1.6 Generate Engineering Report	Stakeholders do not reply through Windchill®	Information does not get archived in Windchill® for future references	2	Stakeholders are not comfortable with Windchill®'s discussion board	3	No current control	1	6	**minor**

		Issue life cycle information becomes incomplete		Stakeholder are not trained in the use and capabilities of Windchill®		No current control			
		ICAT utilities more resources to format and upload reply information into Windchill®							
1.2 Facilitate Meeting	Stakeholders do not get added to Windchill®'s stakeholders list	Stakeholders will not be notified about document and information availability	3	ICAT does not know how to add stakeholders to a project	1	No current control	1	3	minor
		Stakeholders will not receive invites to the project		ICAT did not give ACE the names during project building		No current control			
				ICAT does not add names for fear of uncontrollable access to those users		Access to what other users are able to view or edit is up to the owner of the document			
1.6 Generate Engineering Report	ICAT is not able to store and route documents through Windchill®	Information does not get archived in Windchill® and document management uses up more resources	3	ICAT does not know how to utilize Windchill®	1	No current control	1	3	minor

2.1 Review Issue	Unable to enter information into Windchill®	Information will be stored in the T: drive	3	ICAT does not know how to utilize Windchill®	1	No current control	1	3	**minor**
		Information will only be available to others through ICAT							
2.2 Facilitated Boundary Development Meeting	Unable to record meeting minutes and action items in Windchill®	Information will be stored in the T: drive	3	ICAT does not know how to utilize Windchill®	1	No current control	1	3	**minor**
		Information will only be available to others through ICAT		User does not have the authority		No current control			
2.3 Generate Boundary Report	Unable to store draft in Windchill®	Draft will be stored in T: drive	3	ICAT does not know how to utilize Windchill®	1	No current control	1	3	**minor**
		ICAT will be forced to email draft through outlook							
2.3 Generate Boundary Report	Unable to route document through Windchill®	ICAT will be forced the email and monitor the completion of the document	3	ICAT does not know how to utilize Windchill®	1	No current control	1	3	**minor**
2.3 Generate Boundary Report	Unable to store report	Draft will be stored in T: drive	3	ICAT does not know how to utilize Windchill®	1	No current control	1	3	**minor**
		ICAT will be forced to email draft through outlook							

2.4 Solution Development	ICAT is unable to store updates in Windchill®	ICAT will store updates in T: drive	3	ICAT does not know how to utilize Windchill®	1	No current control	1	3	**minor**
		Information will only be available to others through ICAT						
2.7 Track through Implementation	Updates do not get stored in Windchill®	Stakeholder will be unaware of the status of the issue	3	ICAT is unfamiliar with Windchill®	1	No current control	1	3	**minor**
		Stakeholders reinitiate a problem either on their own or to the ICAT because they feel no one is doing anything about it		ICAT forgot		Process is written so that update are delivered as needed			
2.8 Document History	Updates do not get stored in Windchill®	Stakeholder will be unaware of the status of the issue	3	ICAT is unfamiliar with Windchill®	1	No current control	1	3	**minor**
		Stakeholders reinitiate a problem either on their own or to the ICAT because they feel no one is doing anything about it		ICAT forgot		Process is written so that update are delivered as needed			
1.6 Generate Engineering Report	ICAT does not store or route report through Windchill®	Information does not get archived in Windchill® and document management uses up more resources	2	ICAT does not know how to utilize Windchill®	1	No current control	1	2	**minor**

1.3 Define Action Plan	ICAT does not save final plan in Windchill®	Final plan will not be accessible by others	1	ICAT is unfamiliar with Windchill ®	1	No current control	1	1	**minor**
2.1 Review Issue	Unable to schedule meeting in Windchill®	Meeting will be schedule through outlook	1	ICAT does not know how to utilize Windchill ®	1	No current control	1	1	**minor**
1.0 Claim of Issue	ACE Team is unable to build project in a timely manner	Slows the process down	3	ACE has a high demand of project development without the personal to cover	1	ICAT is able to run in manual mode until the project is created / ICAT will be working toward building their own projects in Windchill ®	1	3	**minor**
2.0 PM On-Switch	ACE Team is unable to build project in a timely manner	Slows the process down	3	ACE has a high demand without the personal to cover	1	ICAT is able to run in manual mode until the project is created / ICAT will be working toward building their own projects in Windchill ®	1	3	**minor**

APPENDIX K

PROGRAM OUTCOMES

Program Outcomes

A. An ability to apply knowledge of mathematics, science, and engineering.

The author applied an engineering mind set to identify and resolve deficiencies between the ICAP and Windchill®.

B. An ability to design and conduct experiments, as well as to analyze and interpret data.

The thesis required the author to conduct tests in the Windchill® software to learn how it works. Some of the tests consisted of uploading, checking out and downloading, editing, checking in, and routing of sample documents. The author analyzed each Windchill® function for ease of use and how it could be applied to the ICAP.

C. An ability to design a system, component, or process to meet desired needs.

The author developed a To-be Swim-lane process map of the ICAP as it could run within the Windchill® software. The process map helped to identify the needs of the ICAP and what Windchill® could offer.

D. An ability to function on multi-disciplinary teams.

The author worked with the ICAT to learn about their requirements. The author also worked with the ACE Team to learn the functions of Windchill®.

E. An ability to identify, formulate, and solve engineering problems.

The author gave a recommendation toward resolution for each deficiency that he identified.

F. An understanding of professional and ethical responsibility.

The author understood that the gap analysis between the ICAP and Windchill® is required prior to integrating the two systems. The author knew that his responsibility was to perform the best possible work in order to obtain early movement toward fully functional database.

G. An ability to communicate effectively.

The author had to effectively communicate his questions to both the ICAT and ACE to smooth out his understanding the both systems.

H. The broad education necessary to understand the impact of engineering solutions in a global and societal context.

   The author understood that his work would affect the ICAT with how it would integrate into Windchill®. Final integration of the two systems will be utilized and seen by multiple users throughout TACOM LCMC.

I. A recognition of the need for, and an ability to engage in lifelong learning.

   The thesis helped to enforce the author's recognition of the need for lifelong learning by reviling new evolving system that requires a user to continue learning in order to remain competitive.

J. A knowledge of contemporary issues.

   The thesis is the groundwork for a modern day issue that is common throughout the community.

K. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

   The author utilized the Lean Six Sigma methodology to identify the deficiencies between the ICAP and Windchill® that will occur during integration.

L. An ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems.

The author is able to work professionally in both thermal and mechanical systems except that these areas of expertise is not required in the development of this thesis.

M. A competence in the use of computational mathematics tools and systems analysis tools germane to the world of engineering.

The author utilized the Lean Six Sigma methodology which is a modern day system analysis tool uses for process development and streamlining.

N. A competence in experimental design, automatic data acquisition, data analysis, data reduction, and data presentation, both orally and in the written form.

During the thesis the author preformed multiple briefings, both orally and written learning and aiding the ICAT.

O. A competence in the use of computer graphics for design communication and visualization.

The thesis required the use of Windchill®, which is an web base software used for document management and storage with discussion capabilities user assignment tools.

P. A knowledge of chemistry and calculus based physics with a depth in at least one of them.

The author has the knowledge of chemistry and calculus based physics that could have been applied to an issue resolution but was not required. The thesis is a gap analysis between two systems and does not require this knowledge.

Q. An ability to manage engineering projects including the analysis of economic factors and their impact on the design.

The author managed the thesis by performing the required steps to identify the deficiencies between the ICAP and Windchill®. Integrating the two will hopefully further streamline the ICAP and reduce the cost of issue resolution.

R. An ability to understand the dynamics of people both in a singular and group setting.

The thesis required knowledge of how people interact with software and how they handle change. The author needed to consider those areas when analyzing the gaps between the ICAP and Windchill®.

S. A competence in the analysis of inter-disciplinary mechanical/electrical/hydraulic systems.

The systems that where analyzed do not require this knowledge. However, this knowledge is required for resolution of the issues that enter the ICAP that is to be integrated into Windchill®.